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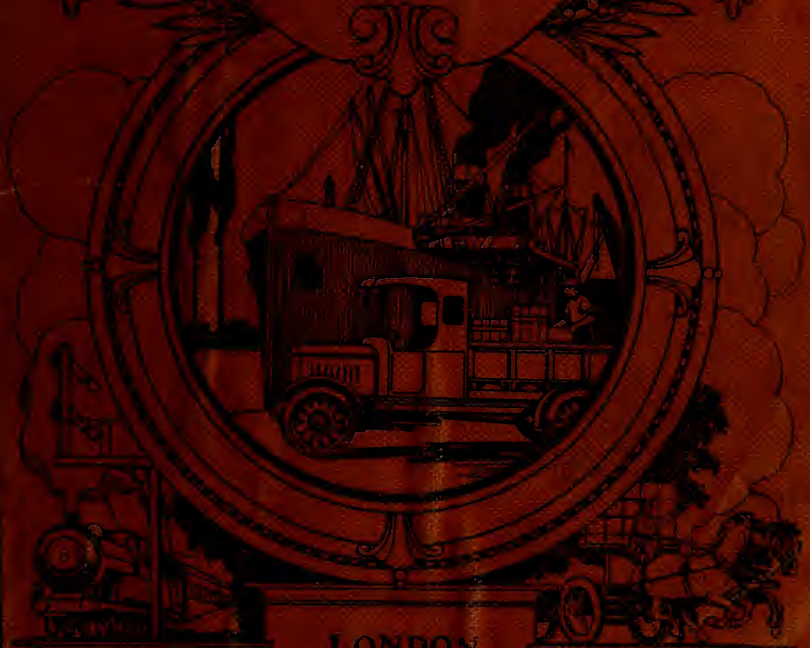
TRANSPORT

THE MAGIC CARPET OF INDUSTRY

by

J. P. GRIFFITHS



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TRANSPORT

A Train of Camels carrying Goods to Distant Markets.

(*See page* 32.)

TRANSPORT

THE MAGIC CARPET OF INDUSTRY

BRIEFLY DESCRIBING THE HISTORY AND DEVELOPMENT OF TRANSPORT BY SEA, ROAD, CANAL, AND RAILWAY

BY

J. P. GRIFFITHS

LONDON

GEORGE PHILIP & SON, LIMITED, 32, FLEET STREET

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PREFACE

THE wondrous Magic Carpet of the old Eastern legend is far out-rivalled by the "Magic Carpet of Industry"—Transport—of the modern world. The restricted influence of the former is not comparable with the influence of the latter, which reaches every home, affects immense tonnage and millions of workers, whilst it dominates the life, languages and customs of the entire world. To include all the details of this mighty organization within the compass of one modest volume is impossible, and the writer's desire is to place before the youthful student some of its many phases. An attempt has been made to treat the subject in an interesting and instructive manner, sketching the history of development in a broad and simple way, and giving in brief outline the methods of working. As an ardent disciple of the economics and practice of transport, it is the hope of the writer that the student may find sufficient

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of interest herein to create a desire to know more of the subject and to study it more deeply.

If the book assists in bringing to the ranks of Transport Workers a greater percentage of those who choose because of that great driving force "Interest," British Transport will better maintain, and probably improve, its position in the forefront, and the labours of the writer will be amply rewarded.

The writer desires to record his appreciation of the kindness of railway officials, editors of railway journals, steamship and canal officers, both in England and abroad, who have acceded so readily to his request for photographs.

JOSEPH P. GRIFFITHS.

CONTENTS

PAGE

PREFACE v

CHAPTER I

THE VALUE AND USES OF TRANSPORT . . . 3

The World without Transport 4
Exchange of Commodities 7
The Miracles of Transport 10

CHAPTER II

A BRIEF HISTORY OF TRANSPORT . . . 14

Early Shipbuilders 14
Great Britain's Contribution 18
Humble Beginnings and Longer Journeys 18
European Discovery of the East 20
The Far West 22
The Dutch Expansion 22
Britain's Overseas Development 24
The Wonderful Transport of the Oceans 27

CHAPTER III

THE STORY OF THE ROADS 31

The Caravan Routes 32
Historical Road Builders 35
Road Construction under Great Difficulties 37
English High Roads 42
The Stage Coach 42
Later Developments 45

CHAPTER IV

THE ARTIFICIAL WATERWAYS—CANALS . . . 47

An Ancient Means of Transport 47
The Canals in Britain 50
Drawbacks to the British Waterways 54
Long Tunnels and "Legging" 56
Some Important Modern Canals 58

CHAPTER V

PAGE

THE BIRTH AND INFANCY OF RAILWAYS . . 62
The Birth of the Locomotive 63
The First Public Railway in the World 65
A Locomotive Competition 68
Opposition to Railways 71
Many New Railroads 73
A Mania for Railways 74
The Battle of the Gauges 77
Britain's "Toy" Railways 79

CHAPTER VI

THE LANGUAGE OF RAILWAY SIGNALLING . . 83
The Beginning of Railway Signalling 84
Railway Policemen 84
More Experiments 86
"Semaphores" 87
The Electric Telegraph 88
Inside a Signal Box 90
Station Bells and Crossing Gates 91
Describing the Signals 92
Other Bell Signals. 95
Signalling in Foggy Weather 96
The Latest Improvements 97
Upper Quadrant or "Three-Position" Signals 97

CHAPTER VII

KEEPING THE RAILROAD IN GOOD CONDITION . . 101
The Platelayer's Work 102
Working in Tunnels and other Duties 103
Renewing the Worn-out Road 106
The Transformation Scene 107
The Final Touches 111

CHAPTER VIII

THE TRAINING AND DUTIES OF AN ENGINE DRIVER . 113
"Knocking-up" the Drivers and Firemen 116
Other Shed Duties 118
Cleaning the Iron Horse 122
A Trial on the Engine 122
With the Driver on an Express Passenger Train 124
The "Right Away" 127

PAGE
In the Tunnel 130
Picking up Water 132
At the End of the Journey 133
The Driver's Knowledge of the Road 135
Driving in "the Old Days" 136

CHAPTER IX

JOURNEYING BY PASSENGER TRAIN . . . 138

Early Railway Travellers 138
Modern Express Trains 142
A Junction Station 146
Gathering and Dropping the Mails 149

CHAPTER X

FROM COLLECTION TO DELIVERY—BY ROAD AND RAIL . 152

Collecting the Goods 153
Arrival at the Goods Shed 153
Transferring to the Railway Trucks 154
Heavy Loads 158
Departure of the Fast Goods Train 159
Assistance in the Rear 162
Train Divided 163
Beyond Control 163
Arrival Next Morning 165
Warehousing and Delivery 167

CHAPTER XI

DISTRIBUTING THE COAL FROM THE COLLIERIES . . 169

At the Pithead 171
The "Coal Age" 172
Controlling the Working of Trains 174
Concentrating and Shunting 176

CHAPTER XII

ACCIDENTS ON THE RAILWAY . . . 179

Out with the Breakdown Train 180
Single Line Working 183
Repairing the Road 185
Rewards for Smartness 187

CHAPTER XIII

PAGE

A LOOK ROUND A RAILWAY PORT 188

Railway Seaport Developments 188
Arrival of Timber and Fish 191
Selling and Sending the Fish 194
Loading the Coal into Vessels 196
Dock Passenger Stations 197

CHAPTER XIV

A FEW REMARKS ABOUT RAILWAYS IN OTHER COUNTRIES . 199

Some Continental Lines 201
African Advancement 206
The American Railroads 207
Colonial Railways 213

CHAPTER XV

TRANSPORT IN WAR TIME 215

Female Railway Workers 217
War Transport on the Roads and Canals 218
Military Roads and Railways 219
Hospital Ships and Ambulance Trains 220
In the Air and on the Water 221

CHAPTER XVI

A PEEP INTO THE FUTURE 224

The Development of the Roads 224
Improving Inland Waterways 227
On the High Seas 228
Under the Water 229
The Future of Railways 230
The Mono Railway 233
Transport and Flight 234

CONCLUSION 238

APPENDIX 241

BIBLIOGRAPHY 247

LIST OF ILLUSTRATIONS

PAGE

A Train of Camels carrying Goods to Distant Markets . *Frontispiece*

CHAPTER I

Steaming to the East. Near Port Said 2
Beasts of Burden arriving at the Market with their Loads . . 5
An Important Calling Place. Port Said 9
Humble Beginnings 9
The Explorers' Transport Difficulties 11

CHAPTER II

Progress in Ocean Carriers 17
Assisting Colonization on the Banks of the Congo . . . 27
Native Carriers. Fording a Stream 28
Transport in the Congo 29

CHAPTER III

A Great Carrier in the Desert 34
A Terrible Road in Russia 36
An American Trail 39
Black Boys carrying Produce to the Markets 40
A Ricksha Puller in Uniform 41
The Stage Coach Snowbound 44

CHAPTER IV

A Dutch Canal Scene 48
On the Canals of Amsterdam the Water reaches to the Doorsteps of the Houses 49
Where the Bridgewater Canal crosses the Manchester Ship Canal. The Aqueduct open 51
Barges in Canal Dock 52
Canal Barges which travel across the High Seas 54
A Busy Corner of a Canal Basin 55
"Legging" a Barge through a Tunnel 56
Entrance Lock to the Docks 57

CHAPTER V

PAGE

Locomotion No. 1, Stockton and Darlington Railway, 1825. The First Engine on the First Public Railway 64
Forty Years Later, 1865 66
Present-day Express 67
George Stephenson. The Famous Engine Builder 68
Sketches of Opening of Liverpool and Manchester Railway, etc. . 69
The "Rocket" 71
Great Western Broad Gauge Railway with Rail for Narrow Gauge between 78
One of the "Toys" loading up at the Station 80
The "Three-Legged" Engine 82

CHAPTER VI

Ball Signals. Board and Disc Signals 86
The First Semaphores 87
Signals are elevated to give a Good View 88
In the Signal Box. Ready to close the Gates 92
The "Fish-tailed" Distant showing "All Clear" 93
Starting Signals at the Station Platform. Separate Signals for the Different Roads 94
Sketch showing Signalling Arrangements at a Small Station . . 95
"Three-Position" Signals 98
The Huge Lift Bridge over the Trent at Keadby 100

CHAPTER VII

Pulling in the Road with Crowbars 104
Taking away the Old Sleepers 108
Trimming up the Old Bed 108
Putting down the New Sleepers and Chairs on a New Bed . . 110
Dropping the Rails in the Chairs 110
Shovelling out the Ballast 111

CHAPTER VIII

The Engine Shed. Outside the Home of the Locomotive . . 114
Inside a Round House. Showing the Turntable in Centre and Pits to enable Mechanics to work underneath the Engine . . 115
The Caller-up sees the Engines in Hospital 119
Taking the Engine for Coal to the Stage 120
Inside the Cab of the Engine 123
Taking the Engine for Water 125

PAGE
A Complete Set of Engine Headlights 126
Express Headlights and a Last Look round 128
As seen through the Cab Spectacles 129
65 Miles an Hour and picking up Water 132
Turning the Engine round on the Table 134

CHAPTER IX

An Old Open Carriage used on the Former Passenger Trains . . 139
"Dandy" Horse and Coach 140
Express travelling at High Speed 143
Platform Electric Truck with Train of Trucks 147
Five-Car Electric Train, L. and Y. Railway 148
About to pick up the Mails 150

CHAPTER X

Lorries arriving in the Shed with the Load 154
Ready for the Night Trains. Loads on the Stage at Noon . . 155
Goods are carefully packed in Covered Vans 156
A Heavy Plate loaded on a Well Truck 158
Loading a Boiler with the Overhead Steam Crane 159
The Heavy Goods Train waiting in the Loop for the Express to pass 160
The Cattle Dock 164
A Quiet Part of the Shed 166
No Delivery on Sunday 167

CHAPTER XI

Transporting the Coal in the Pit 171
Wagons at the Pithead 173
Helping the Trains along. The Train Despatch Office . . . 175
A large Sorting Yard 177
Miles of Loaded Coal Wagons ready for the Steamers . . . 177

CHAPTER XII

The Breakdown Engine and Crane preparing for departure to Scene of an Accident 181
Inside the Breakdown Van 182
Thrown into a Ditch. Willing Helpers at Hand 183
The Bridge gives way. A Nasty Fall for the Iron Horse . . . 184
Clearing up the Line after an Accident. The old Flagman is protecting the Workmen with a Red Flag 186

CHAPTER XIII

PAGE
Constructing a Dock 189
A British Locomotive for Overseas 190
A Large Goods Warehouse at a Seaport 191
Unloading Timber 192
Steam Fishing Trawlers at the Jetty 193
Mending the Trawling Nets 193
Manufacturing Ice 193
Selling a Big Catch of Cod 195
Tipping the Coal into the Ship's Bunkers 196
The Express brings Passengers direct to the Quayside . . . 197

CHAPTER XIV

Signals inside a Large Continental Station 199
State Railway Stations are very large. Central Station, Amsterdam 200
Belgian State Railway Engine. Bricquettes are burned. They can be seen piled on the top of the Boiler 201
Northern Railway of France. Express nearing Calais . . . 202
The Switzerland Express, travelling at High Speed . . . 203
A Congo Railway Station 206
A Sharp Curve on the Congo Line 207
"The George Washington" 208
"John Bull and Train." One of the First American Trains . . 208
One of America's First Engines. "John Stevens" . . . 209
Three Huge American Locomotives 210
The Snowfalls are so heavy that even the heated Engine becomes almost covered 212

CHAPTER XV

Helping to clean the Locomotives in War Time 217
Italians cut a Road out of the Rock to transport Guns and Material to the top of a High Mountain 219
One of the First Ambulance Trains built during the Great War . 221
Warships which guard the Merchant Vessels in War Time . . 222
Hospital Ship "The Britannic" 223

CHAPTER XVI

On the Roads Steam Tractors will carry much Merchandise . . 225
Many Canals will need to be widened 227
Submarine 230
Aeroplanes will play an important part in the Transport of the Future 235
"Handley-Page" Aeroplane being fitted for carrying Passengers . 236

LIST OF MAPS

CHAP.		PAGE
II.	Phœnician and Greek Colonies, with their Chief Trade Routes	15
II.	Portuguese Discovery of the Sea Route to India	21
II.	Spanish Discovery of the New World	23
III.	Ancient Caravan Routes of the Old World	33
III.	The Chief Roads over the Alps	38
III.	Roman Roads in Britain	43
IV.	The Canals of Great Britain	53
IV.	The Great Ship Canals of the World	59
V.	The Railway Systems of Great Britain	75
XI.	Industrial Map of Great Britain showing British Coal and Iron Fields	170
XIII.	Principal British Ports and their Overseas Trading Centres	198
XIV.	The Railway Systems of France	202
XIV.	Principal European Railways	205
XIV.	Some Great Railways of the World	211

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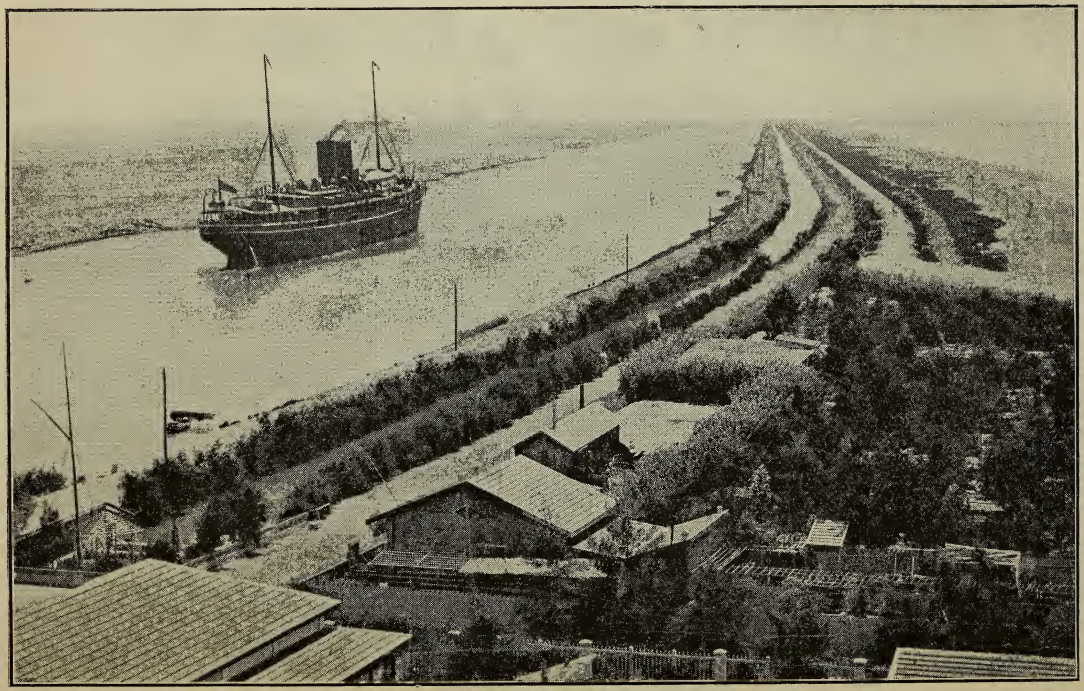


Steaming to the East. Near Port Said.

TRANSPORT

CHAPTER I.

THE VALUE AND USES OF TRANSPORT.

How easy it is to write or speak the word "transport" or to address a label to be fastened on a package, bale or box, destined for China, Australia, Africa, South America or for some lesser-known country. When the carrier has loaded up the consignment on the van the sender calmly dismisses the matter from his mind in the almost certain knowledge that in a short time an acknowledgment of safe receipt will be forthcoming.

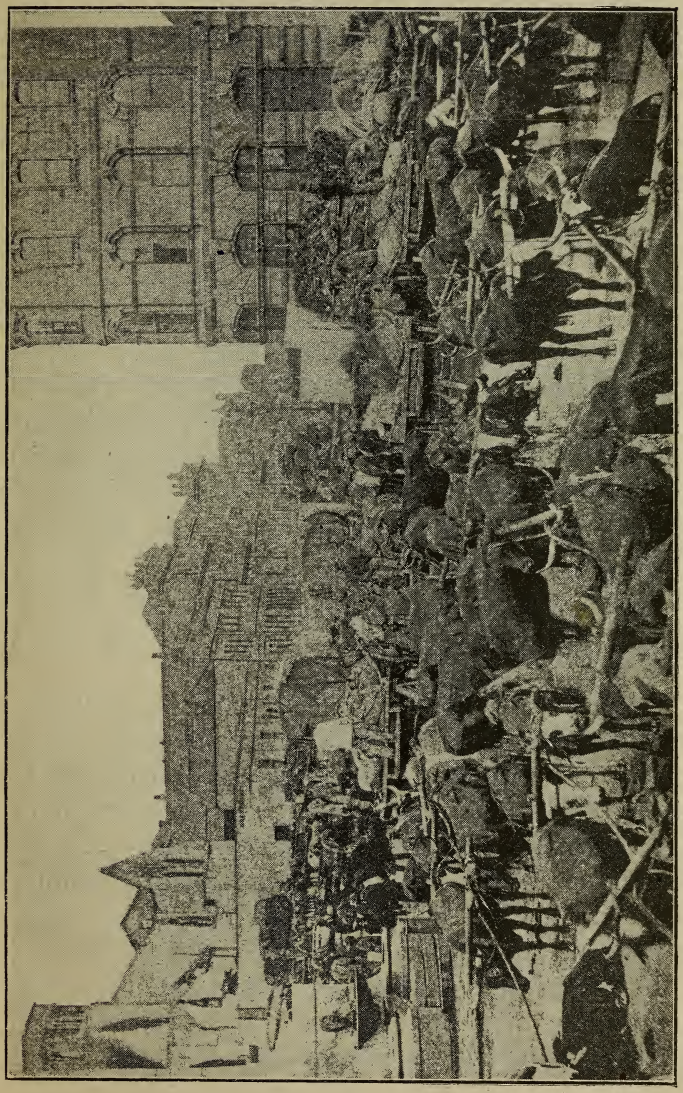
It is all so simple, so many millions of bales and boxes, letters and mails, come and go in the year that the reception and despatch of letters and goods arouse no more emotion than the coming and going of day and night. But transport is a great business, the greatest human organization, which brings us food from all corners of the earth, takes East to West and West to East, annihilates distance, and, in fact, is the prime agent in everything which makes our present system of commercial and social life possible.

What would be the interest to England of tea grown in China and Ceylon if it could not be brought to British inland towns? or where the utility of the great Billingsgate Fish Market if the big catches on the Dogger Bank could only be bought by people who were able to purchase fish on the dock-side at Grimsby or at other fishing ports? Efficient transport is the life-blood of industry, for it performs that vital function distribution.

The World without Transport.

If transportation were now to be neglected, and all our means of carriage were permitted to fall into disuse, many collieries would become idle, factories and works would shut down, and gas and electricity would cease to be supplied. Thousands of articles now manufactured by machinery for our use and comfort would no longer find their way into our homes. Mechanical and other toys would no more be seen in the shop windows or nurseries to delight the children.

If Britain's great coal industry came to a standstill people would again be compelled to gather sticks for the fire, and without the means of carrying stone, strong buildings could only be erected in the neighbourhood of the quarries. All our imports from other countries would be totally cut off. The towns and cities would be deserted and labourers forced to turn back to



Beasts of Burden arriving at the Market with their Loads.

the land to keep themselves and their families in food. Nations would drop back a long, long way, and life would be very different.

This is by no means the full story of the probable results of stopping all means of transit, but sufficient nevertheless to illustrate simply the enormous dependence of modern civilization upon an efficient system of carriage by sea and land.

Nor is transport easy to maintain. It has now become so complicated that very little interference with the delicate machinery throws it out of gear. A few minutes' delay to a train in the North of Scotland may have an important effect upon the running of trains on the Continent through France, Switzerland and Italy, thereby delaying the departure of boats for far-off countries. So important it is that no effort should be spared to ensure the highest state of efficiency in the realm of transport.

The subject has become a scientific study, but a reading acquaintance with its history and a peep at a few of the many sides of this great organ of life at work, will suffice to prove that the subject is full of interest, and that in the sphere of transport there are many professions and occupations worthy of adoption by those who seek for interesting employment.

The desire amongst nations to enjoy the benefits of those things which others possessed and they did not, or if possessed at all only

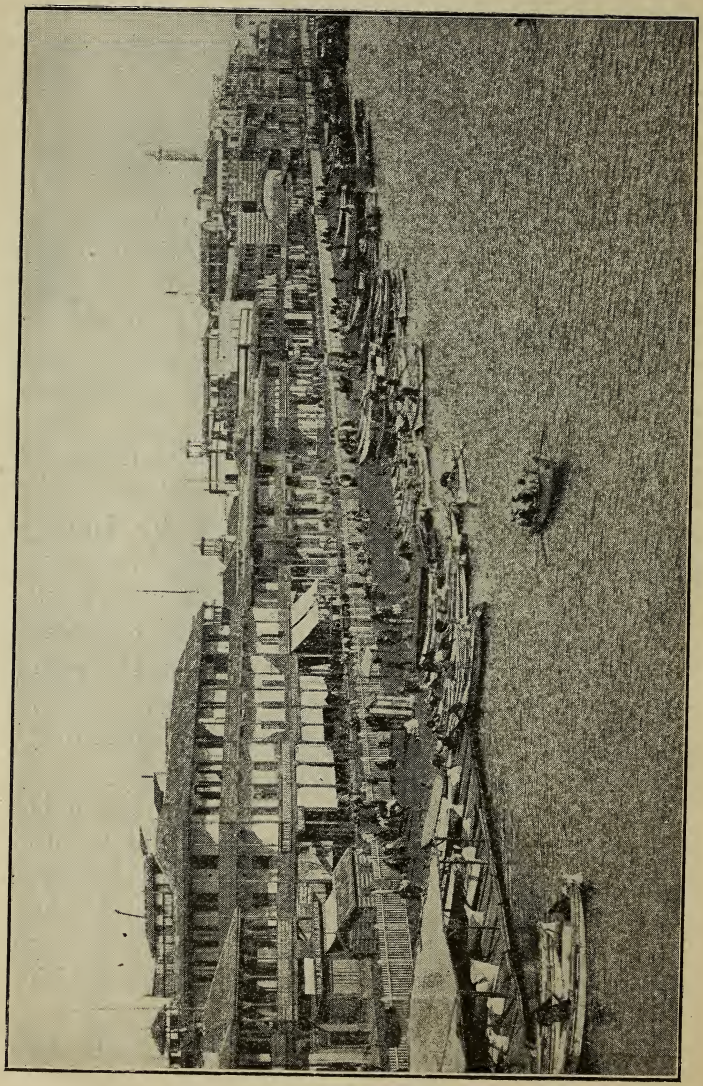
in deficient quantities, promoted the idea of interchange of commodities or, as it is ordinarily termed, commerce.

Exchange of Commodities.

The United Kingdom is essentially a manufacturing country, which sends out chiefly woollen, cotton, leather, and iron goods, largely made from the raw materials received from other countries. Paper, machinery and porcelain, as well as thousands of tons of coal, are exported. In return America sends grain, meat, raw cotton, and copper; Australia, New Zealand, and South Africa mutton, wheat, gold, and precious stones. The homely teapot is filled by India, Ceylon, China and Japan, and the tea is sweetened with cane sugar from the West and East Indies and Java, whilst large quantities of beetroot sugar are exported from France, Austria and Germany. The United States, Mexico, Chile, Spain, Japan and Canada, assist in maintaining the country's supply of silver and lead.

In a large number of Catholic countries it is the custom to eat fish on Fridays, and the wants of these people are supplied by dried cod brought from the fisheries off Newfoundland and the Lofoden Islands in Norway, whilst Spain receives large quantities weekly from the great British fishing ports.

Japan has a great silk industry, and the



An Important Calling Place. Port Said.

silk manufactures she exchanges for cotton and woollen goods and sugar.

Southern and Central Europe, Australia and California, which lie in the warm and temperate regions of the world, send wine and fruits to those colder countries where the vine will not thrive, and where fruit does not flourish so abundantly.

The raw cotton which supplies the cotton mills of Lancashire and comes from the United States,

Photo: *Lent by Baptist Missionary Society.*

Humble Beginnings.

Egypt, Nigeria and India, finds its way back again in due time particularly to the Eastern countries, but then transformed into manufactured articles. Australian wool leaves the Yorkshire towns in quite a different state from that in which it is received.

The Trans-Caucasia, as well as the United States, sends vast quantities of petroleum for fuel, lighting, and the oiling of machinery.

The examples can be multiplied indefinitely,

but the few serve to prove that under a modern system of transport, with its arteries branching in every direction, countries are enabled to supply to one another that which each lacks, whether minerals or metals, food or drink, raw materials for textile and other manufactures, or the finished manufactured articles.

This is the established order of things to-day, but it was not always so. There was a time when nations were ignorant of the existence of any land remote from their own. Their immediate boundaries were to them the uttermost boundaries of the earth. This was the world before transport development.

The Miracles of Transport.

From a humble beginning the achievements of transport have grown greater and greater. With the aid of transport Babylonians, Phœnicians, Greeks and Romans in their turn and in their own way set out to colonize or conquer other countries. Columbus, in his small Spanish boat, sailed across the broad Atlantic and landed in the West Indies. Captain Cook, an English seaman, nearly 150 years ago sailing round the southern seas, dropped his anchor in Botany Bay and planted the British flag on the largest island in the world—Australia. Although Dutch navigators had previously sighted the island he was the first white man to set foot there.

The Explorers' Transport Difficulties.

Tasman, the Dutch sailor, showed the way to New Zealand, and where eighty years ago were fierce cannibal tribes, to-day is a great nation of colonists. The only animals originally found there were rats and a species of dogs, but transport found a way of taking cattle and sheep, and prosperity now abounds.

Many valuable lives have been lost in endeavouring to penetrate regions where civilized man had not previously set foot, but the great pioneers of colonization and transport persevered until there remains comparatively little unknown land on the earth. The British flag proudly floats over an Empire of nearly 13 million square miles with a population of about 450 millions—a great testimony to British colonization and efficient transport.

Alexander the Great, it is said, wept because he could not find other worlds to conquer. In the same way, because there are now no nearer lands to be surveyed, Amundsen, Shackleton, Peary and others devote their years in attempts to explore the extreme poles of the earth. Captain Scott and many other explorers have given their lives to the enterprise.

Transport brought in its train disadvantages as well as great blessings. Warlike nations were enabled to set out from their own countries with weapons of war to attack weaker peoples, to conquer and humiliate them and force the defeated to pay tribute to the victorious.

Pirates in strong ships robbed peaceful traders on the high seas and regarded murder and plunder as an ordinary event, holding human life as a trivial thing.

Men and women, boys and girls, were snatched away from their homes and their relatives by marauding bands. They were carried over sea, mountain and river to distant countries and sold as slaves to the highest bidders. Theirs was a life of misery and torture relieved only by death.

But if transport made these things possible it also performed its part in putting an end to them, for it carried enlightenment and education throughout the world, it assisted in the spread of Christianity with its lesson of brotherhood, leading to the freedom of peoples, black and white. As a nobler civilization grew the slave traffic gradually disappeared. As transport improved the pirates were hunted off the seas and foreign travel became as easy and safe as a railway journey in Great Britain.

CHAPTER II.

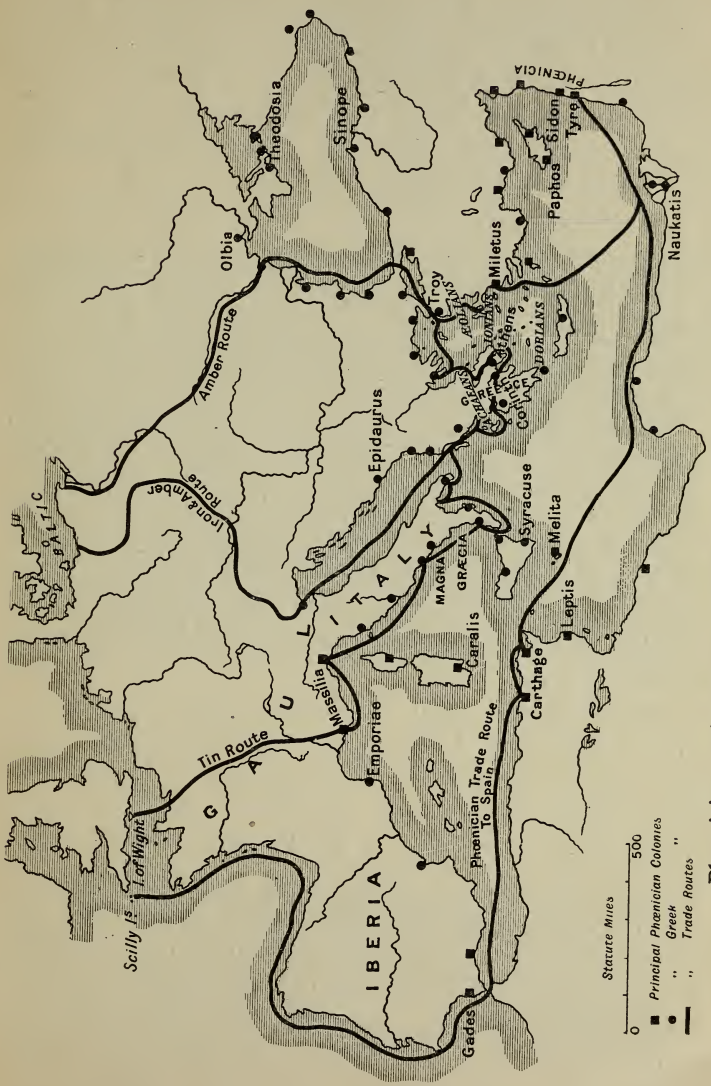
A BRIEF HISTORY OF TRANSPORT.

SCIENTISTS and historians have recorded that, in the earliest days, man acted much in the same manner as animals, obtaining his food as he required it, and consuming it on the spot. His first stage in development was to carry away the things which he fancied and lay them just where it pleased him to do so. This was the initial step in the direction of civilization, and introduced the crudest form of transport.

Historical records do not tell how man came first to make use of other means of carriage and, in the absence of facts, we can only call upon the imagination to assist. Instinct suggests that the boat was made before the cart, or before any beast of burden was used for carrying. Water is an easy means of transport. To convey burdens overland would necessitate some kind of road, or at least the clearing away of trees.

EARLY SHIPBUILDERS.

As far back as 6000 B.C., nearly 8000 years ago, when Babylonian settlers came west to



Phœnician and Greek Colonies, with their Chief Trade Routes.

colonize Egypt, these people brought with them a knowledge of boat-building. In the British museum at the present time is preserved an earthenware jar which shows an Egyptian ship of that time, and, although it is a rough-looking craft, yet it has its mast and a sail.

Markings have been discovered on the walls of the ancient tombs and palaces of Egypt which show the progress made in the designs of ships. Small models, too, have been dug up near the banks of the River Nile, which illustrate the types of boats then used.

The Egyptians gave way to the Phœnicians, who were a great seafaring people even in Solomon's time, with commercial colonies extending beyond the Pillars of Hercules, as the Straits of Gibraltar were formerly called. They sailed far and wide, reaching the shores of England, and, according to tradition, cruised round Africa.

The Greeks and Romans, who succeeded the Phœnicians, built large merchant ships and also ships of war. Greek commercial colonies were added all along the Mediterranean and Black Sea coasts and a lively trade carried on. The Scandinavian peoples had also particularly strong and beautiful ships to carry them to England and Iceland across the rough North Seas as far back as the eighth century. On the Scandinavian coasts rock carvings give an idea of the lines upon which the wild heathens from

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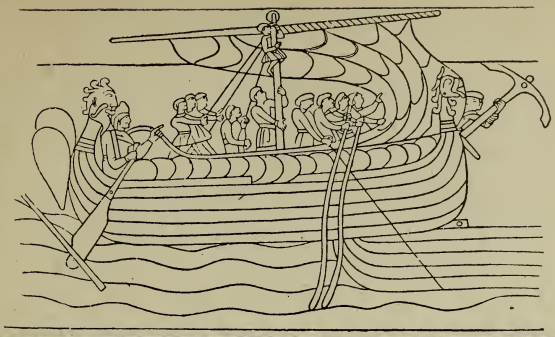

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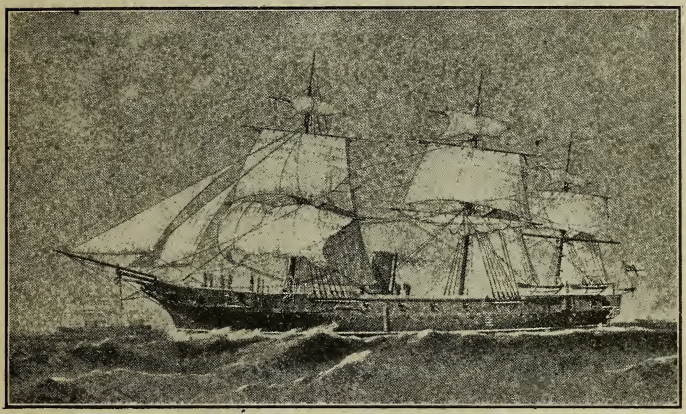


(c)

Progress in Ocean Carriers.

(*a*) An Ancient Boat. (*b*) An Early Steamship. (*c*) A more Modern Liner.

Norway, the Vikings, built their boats, and history books relate how these Norsemen, full of adventurous spirit and desire for rich spoil, sailed much further than England, and landed in Greenland and on the Atlantic Coast of America. The Saxon barbarians from Saxony and Schleswig, the Danes from Denmark, and the Jutes from Jutland, all possessed strong ships in which they raided the eastern parts of England and triumphed over the Britons.

Great Britain's Contribution.

We find, however, that the people in this little island home were not slow to take their part in transport development, for, as one of the great Cæsars points out, the early inhabitants of Britain used skin boats, and only thirty years ago at Brigg, in Lincolnshire, a very early type of boat was excavated. English history speaks of the little boat called the coracle, and even to-day on the rivers Dee and Severn are to be found boats varying little in design from this ancient little coracle.

A wonderful history follows in this famous island, and to-day Great Britain is the mightiest maritime nation in the world.

Humble Beginnings and Longer Journeys.

It would be difficult to say exactly when England commenced to trade with other countries

across the water, but the first records of this country as a trading nation are obtained from the Phœnician mariners who, before the Christian era and the invasion by the Roman Cæsars, brought their boats to the English coasts to trade for tin from the mines of Cornwall.

When the Romans installed themselves in England they made energetic attempts to improve the nation's commerce and were successful in working the mines and in developing the oyster fishery and the farming industry; but after their departure, disorganization appears to have largely ruined the excellent work of the Romans, whilst the Saxons, who next over-ran the country, did very little to develop overseas trade and almost entirely neglected navigation from the shores of Britain.

After the Norman conquest there was a material improvement. The invaders desired to maintain free relations with the continent from which they originated and, therefore, constructed a fleet of ships. Steadily communication with France and Germany increased, and trade with certain parts of Norway, Sweden and Denmark also was developed.

There was considerable advancement at the end of the twelfth century upon this humble beginning when Richard I. went out with his armies into the Mediterranean Sea to assist the Crusaders in the establishment of a Christian kingdom at Jerusalem. The carrying and

provisioning of these great Crusading armies called for a large addition to the number of ships, and the sailors, observing the splendid possibilities of trade at the various Mediterranean seaports, carried with them in their ships the raw materials and products from home and exchanged them for the luxuries of the East. Thus was introduced an important trade with the great emporiums of the Mediterranean—Venice and Alexandria—which were the principal trade centres and distributing points for eastern and western merchandise. From these ports the Arabs had complete control of the trade of the East, making their return journeys overland throughout Asia.

European Discovery of the East.

To the Portuguese belongs the honour of commencing the great overseas expansion. In the early part of the fifteenth century Portuguese explorers made voyages along the North-West Coast of Africa, but it was Prince Henry, called "The Navigator," who made a great study of Geography and Navigation, and sent his sailors further south along the coast, resulting in the discovery of the Senegal and Gambia Rivers. Prince Henry died in the year 1460, but the good seed he had sown brought forth abundant fruit, for the great bend of the coast round Cape Palmas into the Gulf of Guinea was navigated and with

continued success, until at last one of his successful followers, Bartholomew Diaz, steered his ship eastward round the Cape of Good Hope.

This signal triumph of the Portuguese seamen resulted in another of their countrymen, Vasco da Gama, setting forth on an expedition further

Portuguese Discovery of the Sea Route to India.

afield. Following the direction of his predecessor he sailed round the South of the African Continent and in May, 1498, had the honour of leading the first European ship to the Great Peninsula—India, landing at Calicut.

Trading stations were soon formed along the

Malabar Coast and, not content with these successes, other Portuguese ships went further east and sailed into the Chinese River Canton.

The Far West.

Whilst the Portuguese voyagers were opening out for Europe a wonderful market in the East the Spaniards were busily engaged in exploring the Western world under the direction of the Great Columbus, along with adventurous Spanish navigators. Disputes and jealousies between the rival nationalities resulted in Pope Alexander VI. deciding that the Portuguese should sail undisturbed towards the East and the Spanish ships should confine their activities to passages across the wide Atlantic, and be free to become the lords of Western discovery.

The Dutch Expansion.

They were not, however, to be left in undisputed possession, for the Dutch, gaining their freedom from the yoke of Spanish oppression, immediately turned their eyes towards the great magnet of Eastern commerce. They were an industrious people, carrying on great fishing and woollen trades and aimed at occupying the leading position amongst the great ocean carriers of the world. Expeditions were sent out to the

frozen Arctic seas in order to find what is termed "The North-East Passage" to India, but were unsuccessful, so they followed by the Cape route in the wake of the great pioneers, the Portuguese. The people of the Netherlands were keenly

Spanish Discovery of the New World.

anxious to reach the Asiatic markets. They had no scruples about dignity or even religion, and obtaining much assistance from the Mohammedans succeeded in wresting the major portion of the Indian trade from the Portuguese. The Mariners

of Holland worked their way to the richest Eastern possessions in Ceylon and the Indian coasts, establishing themselves also on some of the most important islands between the Indian Ocean and the Chinese seas.

The Portuguese, not having important manufactures or agricultural produce, had not a great deal to offer in exchange for the spices and products of the East, and gradually their influence in and about India declined. Meanwhile the Dutch trade grew enormously.

Britain's Overseas Development.

During the time when Spain, Portugal and Holland were making history in the discovery of new trade routes and the opening out of countries hitherto unknown to Europe, the English were engaged at home with internal troubles, attempting to overcome the resistance of the Scots. Apart from a few voyages taken in Portuguese ships along the African coast British seamen and traders were almost entirely ignorant of the new world which had been brought to light. Awakening to the realization of the nation's backwardness, ships of oak were fitted out for long voyages in order that the merchants of Britain should share in the rich trade spoils.

Naturally Britain's intrusion was very strongly resented by the nations who were already establishing themselves and there was no alternative but

to fight for expansion. The names of Drake, Hawkins, Frobisher and Sir Walter Raleigh, who, during the reign of Queen Elizabeth, commanded various expeditions East and West, will remain immortal. Sir Francis Drake, particularly, laboured long and unceasingly to cripple or destroy Spanish influence in the West, because the Spaniards refused to recognize the English right to trade, and when he died, near the close of the sixteenth century, Britain had been raised to the rank of the first commercial power. Her ships were sailing both East and West to the far away countries of South America, Africa, India, China and even to Japan.

England awakened to the fact that the ships of the Netherlands were carrying the larger proportion of the Eastern trade and practically all imports from that quarter to England. To prevent this monopoly continuing, the English Parliament refused to accept merchandise brought to England in Dutch ships. This led to war, but eventually the Dutch admirals, Van Tromp and De Ruyter, were overthrown and the ascendancy of the Dutch in the East came to an end.

The Arabs first monopolized Eastern trade-carrying across the desert, and the Portuguese by discoveries at sea destroyed this monopoly. They were in turn largely forced out by the Dutch whose triumphant reign was brought to a close by British enterprise and a great Navy. The failure of the Portuguese was due to their

inability to colonize the lands they occupied, whilst the Dutch were in too great a hurry to become wealthy. In the West Spain's greed of gold and silver proved her undoing. Englishmen at first were chiefly animated by the outstanding resolution to find new markets for the manufactures and products of the home country, to assist in establishing new industries, and to promote the growth of foodstuffs. The result was to greatly increase the trade between the new colonies and Britain, and was the keystone of success.

Although England soon obtained the mastery of the seas, rival nations continued to send out expeditions to various parts of the world. By these means the dark Continent of Africa was explored along the banks of the great rivers, reaching farther and farther afield until to-day there is very little of the African continent which can be regarded as altogether unknown.

Discovery has since been made easier, resulting in the settlement of Australia, New Zealand, Canada, and the complete conquest of India, bringing these countries within the commercial circle.

The fifteenth and the greater part of the sixteenth centuries stand out as the age of progress in commerce. The discovery of the Sea Routes to the East, and the tremendous growth of the North American colonies brought about a vast change in the European idea as to the extent to which trade and colonization might be attempted. Increased shipping resulted in the creation of

many more seaports in this country, the Atlantic trade being notably responsible for the development of Liverpool. It would be difficult to overestimate the immense advantages of these

Photo: *Rev. Wm. Forfeitt (B.M.S.).*

Assisting Colonization on the Banks of the Congo.

wonderful voyages and discoveries, particularly of the fifteenth and sixteenth centuries, in seas where hitherto no European boat had sailed.

The Wonderful Transport of the Oceans.

The ocean charts have become lined with innumerable sea routes forming a mighty network branching in all directions like railways in a prosperous country. Steamers travel with the

regularity and punctuality of the railway service, departing and arriving at scheduled times, and on the busy routes there are the important calling places like the large intermediate and connecting stations of the principal railways. Vessels steaming through the Mediterranean to the Far East, Australia and New Zealand must refill the ships'

Photo: *Rev. F. Beale.*

Native Carriers. Fording a Stream.

bunkers with coal, and goods are also discharged for, and loaded from, localities where they do not call. These depots, important amongst which are Gibraltar, Algiers, Port Said, Aden, Colombo, Singapore, Hong Kong, Shanghai, Yokohama, are great aids in maintaining long distance ocean carriage and in assisting distribution.

Boats travelling to Cape Town and also to

the South American ports call at St. Vincent in the Cape Verde Islands, St. Thomas and St. Lucia in the West Indies, whilst Norfolk on the coast of Virginia and Buenos Ayres, the great port in Argentina, are important coaling stations in the west. In the Pacific Ocean the two out-

Photo: *Rev. F. Beale.*

Transport in the Congo.

standing places used as ports of call are San Francisco and Honolulu.

Columbus made his famous voyage across the Atlantic in a ship of 100 tons. Regard the development in this direction. Huge liners of 50,000 tons plough their way across the Atlantic and Pacific carrying enormous tonnage of merchandise, and whereas in the old days ships were

few and far between, to-day there is a continuous stream of boats, varying in size from the mighty liner to the small ocean tramp steamers.

The Ancients regarded the sea as the enemy of man, but, used for transport, it has proved to be humanity's greatest friend.

CHAPTER III.

THE STORY OF THE ROADS.

THE roads, the oldest medium of land transportation, are ancient, being used long before canals were made or any form of mechanical transport had been even dreamt about.

The savages, in hunting their food, by force of habit would probably take the same direction from time to time, and though there were no clearly defined pathways, such as could be traced by the ordinary observer to-day, still a track eventually would be made, which, to the keen eye of the uncivilized savage, would be plain to follow, and more than sufficient to lead him to the haunts he desired to visit in his search for food. The streams and rivers existed, but, except to follow their banks to catch the fish, he had not learned to make any other use of them.

A country walk furnishes an illustration of the simplest kind of road. A field path trodden down by the villagers constantly tramping to and from their work, or between different villages, tells how the early inhabitants of the earth first linked places together.

In the East, where trading began long before

it invaded western countries, camels, mules and asses were at an early date utilized to carry the goods for barter. Man, recognizing his inability to carry all he wished, and perceiving how the strong animals, running wild in his country, were better endowed by nature to bear burdens, captured and trained them to do his bidding. By this means he was able to rid his shoulders of heavy burdens and to travel much further afield, taking greater quantities along with him.

In India elephants were hunted into compounds and tamed and taught to act as carriers of merchandise and passengers. This was an important advance, as one of these huge animals can, without great difficulty, take a load of half a ton in a single journey.

The Caravan Routes.

On the great caravan routes, in districts clear of sand, the road became quite distinct, and constant tramping by men and beasts of burden made a good track. In the deserts it was very different, as footmarks were soon covered by the fine sand often blown in dense clouds. Owing to the lack of a clear path from one well or oasis to another many lives have been lost in the Sahara and in the Arabian deserts, and numbers of skeletons of man and beast remain to mark the hopeless wanderings of lost travellers.

The great processions had to depend upon the

Ancient Caravan Routes of the Old World.

Arab guides to lead the way across these seas of sand. Aided by the camels these men who spent their lives in and about the desert, knew their way, by an almost uncanny instinct, to the wonderful oases at which camp was made, and beasts and men could obtain refreshment and

A Great Carrier in the Desert.

supplies of fresh water. Even in the distant past roads had distinguishing names. An invading race came to Egypt by what was called the Kesseir Road 5000 B.C.

As a means of moving heavy loads tree trunks and logs were first used, but a considerable amount of time was wasted in continually placing the logs underneath, as the load was pulled

forward. It is suggested that the rolling of these logs first gave the idea of saving the labour of haulage, by using a roller or wheel, and this probably led to the invention of the axle, which produced the wheeled cart.

Historical Road Builders.

The Romans, however, were the chief pioneers of road-making. Wherever they went their landmarks in the shape of good straight roads were left behind. The Roman had a great belief in the value of good roads, particularly in a country which they had set out to conquer, and they principally employed criminals on the work.

These roads were of important military value for armies moving swiftly from one place to another; they were useful in maintaining the supplies of food, and were of considerable strength.

A number of the Spanish railway stations still retain the old names given to particular spots on the ancient roads where oxen, horses, mules and carts were kept.

Napoleon, the great military genius, who for a long time disturbed the peace of Europe, provided France with a magnificent system of roads. Paris is the centre, and long roads shoot out to north, south, east and west of the country, connecting the French capital with almost every place of note in the country. The French system

of roads is recognized as probably the best in Europe.

The Roman Cæsars omitted Russia from their

A Terrible Road in Russia.

conquests, and this enormous country is very poorly provided with roads. No genius holds in

Russian history a name for the establishment of an excellent system of roads; in fact the Russian system of transport generally is weak. It was never considered worth while to make good roads, because, for a great part of the year the ground is covered with snow, and roads of frozen snow are useless for wheeled carts, so that sledges form the principal means of carriage.

Owing to the severity of the climate, in Canada, also, the carts disappear from the streets in winter and sledges take their places.

Along the roads in Norway there are still to be found huts, far removed from the regular inns on the routes, at which travellers can obtain temporary shelter from the rough weather. At these shelters the Government also keep horses and vehicles which can be hired by travellers.

Road Construction under Great Difficulties.

The main roads in Italy connecting the provinces with the seaports cross the mountain ranges of the Alps and Apennines, and are often marvels of engineering skill.

For wonderful mountain roads one must visit Switzerland and Italy. The roads approaching the lakes of Northern Italy from Switzerland lead over the passes to St. Gothard, Simplon and the Splügen. The cost of constructing these roads both in time and money was immense, and

the work was carried out under great difficulties and with many disappointing setbacks, and it is a marvel that the engineers did not despair. In places the pathway has been actually cut out of the face of the perpendicular rock with a fearful chasm below and towering cliffs above, whilst

The Chief Roads over the Alps.

the route in some parts is a series of zig-zags up the side of a mountain. Very few years pass without some portion of one of these roads being destroyed by storms and avalanches, thus entailing considerable work and expense in renewal. These were the old and only connecting links

between France, Switzerland, and Italy by land. One of the greatest disadvantages of Swiss roads is the excessive amount of snow which falls and has constantly to be cleared away to make the roads fit and safe for traffic.

America is a go-ahead country, but of great

An American Trail.

roads there are very few. Colonization there was carried out by making and following a trail (to call it a road would be flattery and exaggeration), and when a few settlers had built together a small colony, along came the railway, overcoming all natural difficulties.

There are, too, the ice-bound regions of the North, where frost and snow abound the whole year long. The Laplanders can have no roads built of stone or wood, but under the far-flashing meteors, the fog circles and the gorgeous lustre of northern lights, dogs and reindeer drawing

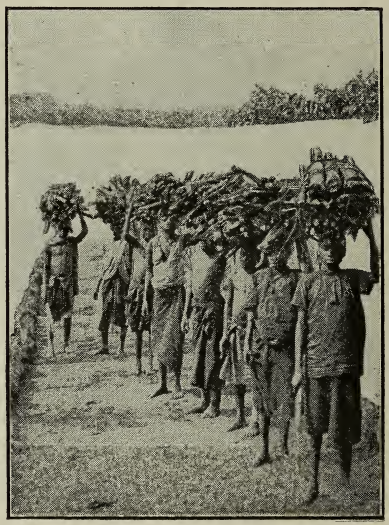


Photo: Lent by the Baptist Missionary Society.

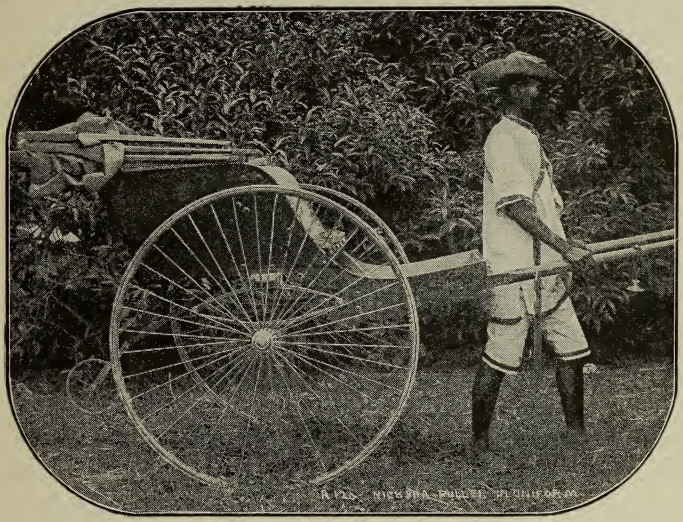
Black Boys carrying Produce to the Markets.

sledges skim over the ice and provide the necessary means of transport.

In Australia in the early days of the country's development the roads were very bad. These were simply tracks through the bush made by men in a hurry to get rich at the gold mines. In

summer these tracks were inches thick with dust and sand, whilst during winter time there was a great depth of mud.

There is little need for roads in Holland seeing that canals usually take the place of streets and



A Ricksha Puller in Uniform.

roads. What roads do exist are mostly paved with brick.

An interesting feature of transport in the streets of Belgian towns and cities is the use made of dogs in drawing small carts, in going the rounds with the milk, and generally in assisting the road transport.

The black woolly heads of the African natives

were at one time the chief means of carrying goods through the forests and jungles of Central Africa, and they still do their part. Black boys between the shafts of rickshaws help in passenger transport. In the mountains of Asia even sheep are utilized for carriage. Yaks are used in Central Asia. The South African oxen trek from point to point through the veldts over the wide tracts of country, but there is very little guidance in the shape of well-defined roads.

English High Roads.

In England some of the roads made by the Romans are now unused, but others form to-day important highways: *e.g.* Ermine Street, Icknield Way, Fosse Way, and also Watling Street, which runs west from London across England; and who has not heard of the great North Road running out of London, through Peterboro, Doncaster, York, Durham and Newcastle, which gave the direction for the Great Northern Railway to the North of England and thence on to Scotland, along which traces of Roman camps are still to be found. A huge stone bridge of fifteen arches crosses the Tweed. This was completed in 1634 and occupied twenty-four years in the building.

The Stage Coach.

In 1784 the first mail coach was placed upon the English common roads. There had been

coaches in use previously, but they were few in number, and better coaches having greater speed improved road travelling. The guard, clothed in his red coat, and perched in his little box behind,

Roman Roads in Britain.

blew his horn as they approached a town. Some of them relieved the monotony of the journey by entertaining the passengers with selections on the fiddle, or other instrument, while the coachman with the reins told his stories of the road. Inns,

where refreshment could be obtained and the horses changed, were placed at intervals on the route, and many can still be traced by their names such as "Coach and Horses" and "Wagon and Horses." When entering a village, the coachman cried loudly "Tally Ho!" and the folks would

The Stage Coach Snowbound.

rush out to admire the splendid teams of steaming horses and to hear the news from distant towns.

The old roads in this country failed as an efficient means of transport chiefly because they were unable to accommodate all that it was desired to send. The pack horse and the horse-

drawn carts nobly endeavoured to rise to the occasion, but the disadvantages were heavy against them. In the first place there were very few roads which could be called great highways, and even these, in the majority of cases, were in such a state of neglect that it is not to be wondered at that some other means of carriage was sought.

Later Developments.

Two men, Macadam and Telford, later recognized that if roads were to be of any use for heavy loads they would require to be much stronger and better able to withstand the constant grinding of the wheels on the soft earth and clay forming the greater part of the rough stone ways, and they set out to improve the methods of road-making. Macadam decided that stones broken up and placed in layers would be strong enough, whilst Telford built up a foundation for the real road to rest upon. These well-recognized methods of road-making have been adopted with marked success in this country and elsewhere, and have led to considerable improvement, and to an important revival in the ancient method of consigning goods and carrying passengers by road.

In the first half of the nineteenth century good turnpike roads were made up and down the country, although, speaking generally, the

system of road communications still left much to be desired.

In the cities and towns large stone setts are utilized for paving the streets, but in the city of London wooden setts have been largely adopted. Without such all-round improvements it would not have been possible to introduce suitable light motor cars having wheels with inflated tyres, as by running at high speeds on the old roads accidents would have been quite common, owing to the deep ruts which would throw the vehicles over. The heavy motor lorries would soon have made great holes undoubtedly a menace to all road traffic. Owing to the improvements in road-making it has been found worth while to build new ones and to widen existing roads capable of carrying much heavier and speedier traffic. Following upon the omnibus, which was a later development of the stage coach, came horse-drawn tramcars running on steel rails. These have given way in turn to the faster and heavier electrically-driven trams, and in addition petrol and steam cars and lorries.

Noteworthy advances have been made also in road lighting. From no lights at all torches, candles, oil, gas, and electric lamps have followed one another: being great and progressive changes from an occasional "cresset" or beacon light, one of which can still be seen on the tower of Hadley Church, near London, on the North Road, exhibited to guide wayfarers through the woodland.

CHAPTER IV.

THE ARTIFICIAL WATERWAYS—CANALS.

Following upon the general use of roads and rivers, on which all inland trade had been transported, the world's system of canals next played its part, and there are many influential people who are strongly of opinion that it is destined to play a still more important part in the future.

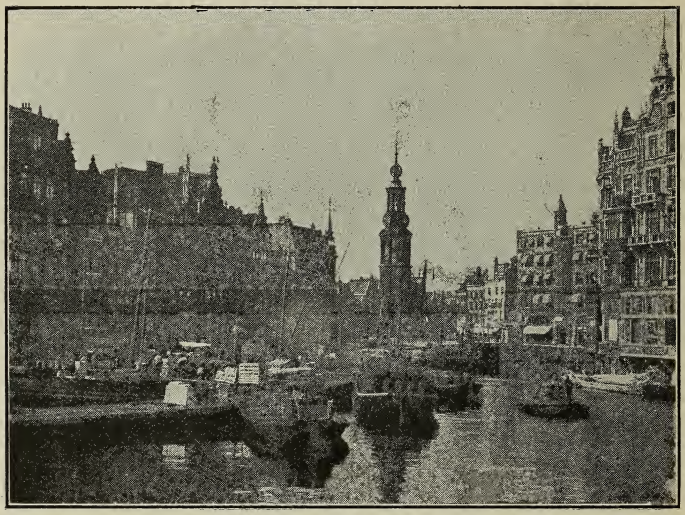
In many cases, mainly where there were no natural streams, canals were built for irrigation purposes, particularly in Egypt, China and India, and several are still retained for this sole purpose. But for commerce the main objects of canals are threefold—

1. Connecting centres of population where there were no navigable rivers.
2. Connecting river systems or avoiding cataracts, waterfalls, shoals or rapids.
3. Ship canals as a means of connecting ocean, sea and inland towns.

An Ancient Means of Transport.

It would be difficult to say which nation first constructed canals for transportation purposes,

probably the Egyptians, but the Chinese, although regarded as a somewhat backward people in commercial enterprise, nevertheless had large canals some hundreds of years before the first canal was cut in this country. The Grand or Imperial Canal of China, connecting Tientsin on the Peiho with

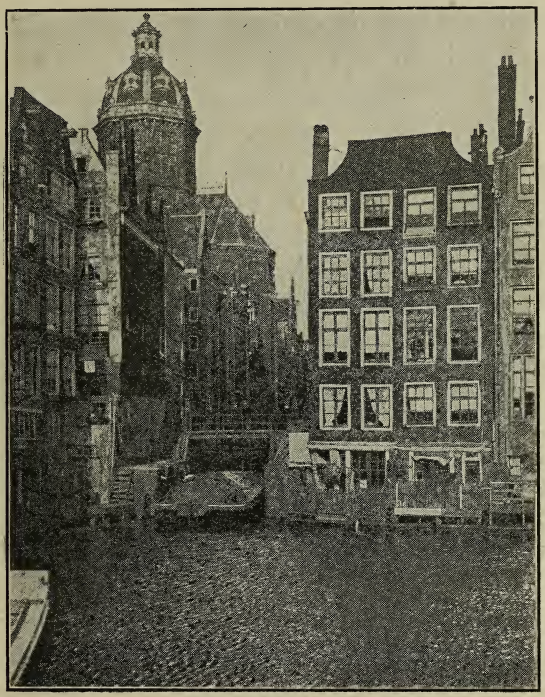


A Dutch Canal Scene.

Hangchow, was commenced in the seventh century, and was not completed until 600 years later in the year 1292. Though the construction occupied such a long period to complete it was indeed a remarkable achievement.

Germany paid and continued to pay considerable attention to the establishment of navigable

waterways, and France, by canal systems, connected all her important rivers entering the sea with the great rivers Rhone and Rhine, whilst the



On the Canals of Amsterdam the Water reaches to the Doorsteps of the Houses.

canals in Belgium and Holland are also extensive. In Holland many people are born on the canal boats, on which too they often pass their whole existence. They have their festivities and even

gardens there. The Dutch canals are of all sizes from the North Holland Ship Canal, which runs from Helder at the entrance of the Zuyder Zee to Amsterdam, fifty miles long and forty yards wide, to small ditches, as one might almost call them, across which an active boy can leap.

Water omnibuses are constantly plying up and down these water roads, conveying passengers from place to place, just in the same way as street cars and 'buses do in England.

The canals are fed with water by means of windmills, of which there are said to be at least 10,000 in Holland, which pump the water from the lowlands into the canals.

The Canals in Britain.

It was not until the year 1755 that the Duke of Bridgewater constructed the first canal in England. This was only a short canal from Manchester to Worsley, but rapid progress was afterwards made, as during the next seventy years no less than 3000 miles of canals were opened for traffic in the United Kingdom.

In the North of England the canals pass from West to East, from the River Mersey to the River Humber. From the port of Goole on the River Humber a series of canals links that river with the Thames. A canal system flows to the Severn from Staffordshire, whilst Coventry, Oxford, Warwick, Birmingham and the Grand Junction

Canals form a continuous water-road from London to Wolverhampton, through Northampton, Rugby, Coventry and Birmingham.

Factories and workshops soon sprang up by the canal side, many of them being provided with a small dock in their yards so that the boats could be drawn right inside and unloaded or loaded on the spot.

There are many difficulties attached to canal

Where the Bridgewater Canal crosses the Manchester Ship Canal. The Aqueduct open.

construction. Roads can be made through the deepest valleys and ravines, over rivers and streams by means of bridges, across other roads, over the tops of mountains, cut along the sides of cliffs, and even taken across bogs and marshes; but waterways, which are to be made suitable for navigation, must flow through generally level country, as it is a simple natural law that water

tends to find its own level, and the area of usefulness of the canal is thus considerably limited.

It was difficult to find suitable conditions in this country which would allow of canals being made over any great length without encountering a rise in the land too great to allow of the water

Barges in Canal Dock.

feeding properly, but engineers were not dismayed by natural obstacles of this kind. The canals were built in steps from one level to another, by means of locks. In these locks a barge can be raised from a lower water level to a higher, or gradually let down from the higher to the lower, according to the direction in which the boat is travelling.

Where the ground rises rapidly, one lock is insufficient to elevate the level of the canal to the higher ground, and in some cases a series of locks

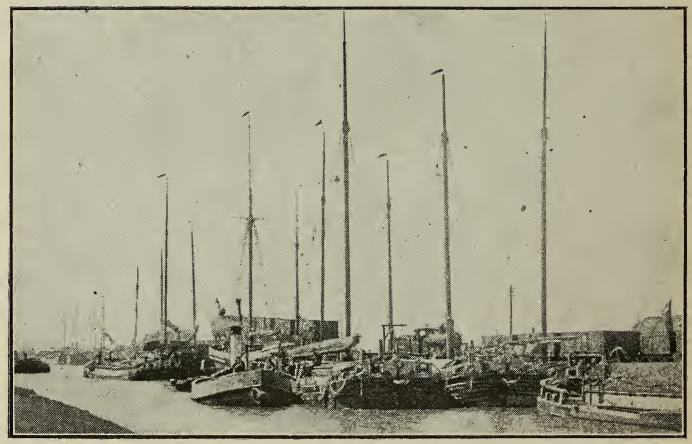
The Canals of Great Britain.

had to be built. There are instances where locks following one another form a kind of staircase up the rising ground.

The users of the canals paid tolls for the use

of the waterway, the following being the charge made :—

Ironstone, iron ore, coal, limestone, lime and all kinds of manure	2d. per ton per mile.
Stone, iron, timber, goods, wares, merchandise and other things	5d. per ton per mile.



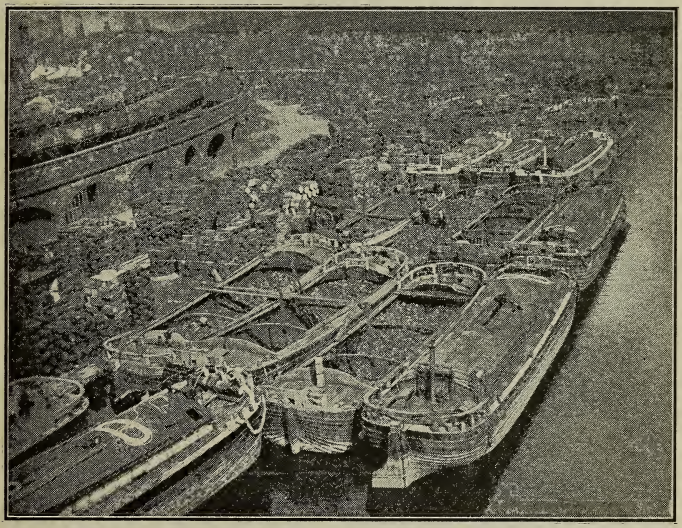
Canal Barges which travel across the High Seas.

A striking contrast to the thousands of rates now in operation on the railways.

Drawbacks to the British Waterways.

Our canals, unfortunately, were built without any attempt at uniformity. This was the result

of a shortsighted policy of digging canals, building boats and constructing locks to satisfy personal and local ideas, instead of taking into account the needs of the country as a whole. In one locality long, slim barges were made, whilst in another the boats were short, but broad. Naturally the locks were



A Busy Corner of a Canal Basin.

made in accordance with the shape and size of the boats, with the result that a broad barge cannot travel along a canal with narrow locks, nor can a long boat make a journey on a canal where the locks are wide enough, but too short. Stout boats, therefore, must remain on their own canals, and

narrow ones are confined to their particular district.

If a load of coal or agricultural produce is sent by water and, in order to reach its destination must be carried on these different classes of canals, there is no other course open but to transfer the mineral or foodstuffs from one canal boat to another, which is a very slow business and means extra handling and expense.

Long Tunnels and "Legging."

It was not always possible to take canals over hills by means of locks, and so the alternative of boring a tunnel through the earth was adopted. Now, horses are the principal beasts of burden in England to draw the boats along these waterways, but in some of these canal tunnels it would seem as though the towing path had been left out of the engineer's calculations, for the water laps gently against the sides of the wall, and the horses must remain outside. In these places the boatmen therefore have to do the work themselves. The men lie

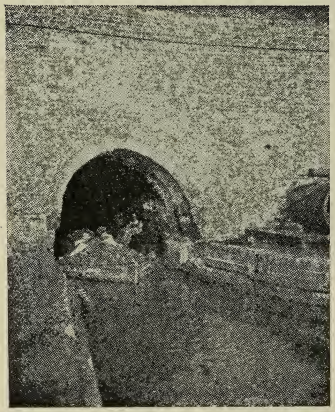
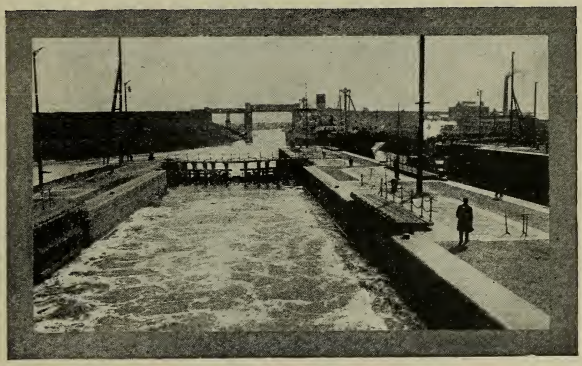


Photo: *E. A. Pratt.*
"Legging" a Barge through a Tunnel.

on their backs, one at each side of the boat, and, pressing their feet against the tunnel walls, push the boat through, in this manner, to the opposite end to where the horse has been led once more to provide the motive power. But "legging" is arduous and slow work.

There are a number of long tunnels on the canals, of varying lengths, more than twelve being



Entrance Lock to the Docks.

considerably over one mile, whilst the tunnel at Standedge is more than three miles in length. Like the locks, the tunnels are of different widths, and the difficulty of through transport is greater on this account, as it is far more difficult to increase the width of a long tunnel than to alter the dimensions of a lock.

The owners of the canals in England, however, made a still greater mistake than that made by

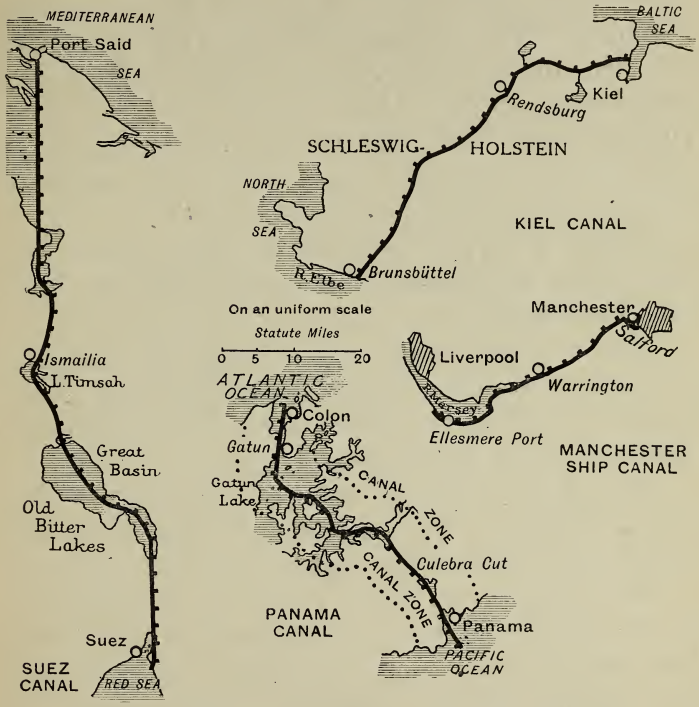
those who designed the canals and boats. They continually turned a deaf ear to the repeated appeals from traders to reduce the rates, which were considered much too high. As an example, too, of the easy-going methods of canal owners there are instances on record of canals being frozen over, and owners refusing to break the ice as they held they were not bound by law to do so.

Small wonder then that in a progressive age merchants were, in many districts, ever searching for some new means of carriage.

Some Important Modern Canals.

If many of the canals in this country failed to keep pace with the growing demand for transport facilities following the revolution in commerce caused by the introduction of steam, it did not mean that they were altogether useless, or that it would be madness and ruin to construct others. The general opinion, however, seemed to be that after the opening of railways, canals were doomed, but the more modern history of transport suggests that there are directions in which the canal can still be a useful agent of carriage. The Manchester Ship Canal is a great engineering feat. It was commenced in 1886, and opened for traffic by Queen Victoria in November, 1893. Entered from the sea at Eastham, a point in the Mersey estuary four miles above Birkenhead, the canal is a means of connecting the important City of

Manchester with Liverpool and the whole of the world's ports from which raw materials can be received direct, and to which manufactured cotton



The Great Ship Canals of the World.
(Drawn on a uniform scale.)

and other goods can be sent all the way by steamer.

The cutting of the Suez Canal has considerably shortened the distance between the West and India. A new short route was opened in 1840 by

taking goods on the steamer from Bombay to Aden, and along the Red Sea to Suez. Here the goods were discharged and taken overland to Alexandria, and then once more loaded up on steamers. The opening of the Suez Canal in 1869 avoided this disembarkation at Suez, and allowed vessels to continue their journey without interruption from Port Said on the Mediterranean to the Indian Ocean, covering the whole distance without the assistance of locks.

There is now a network of canals about the Nile basin intersecting the country like the lines on a chessboard.

The Corinth Canal, cut through the Isthmus of Corinth, avoids a dangerous passage and saves several hours in the journey by water from the Adriatic to the Ægean Sea.

The Kiel Canal provides a way out of the frozen Baltic in winter, and has thus made the Baltic Sea a more important commercial highway.

The greatest modern canal is the Panama. It was constructed under stupendous difficulties, and cost enormous sums of money; but although the original French Company which undertook the work was compelled to abandon it, the canal was at last completed by the United States Government. Cut through the Isthmus of Panama it provides a short passage from the eastern ports of America to San Francisco and other places in the Pacific, thus saving a long sea journey round the South American Peninsula.

These and other important canals have added greatly to the general utility of water transport, and there can be no gainsaying the value of canal transport in many parts of the world. Its possible future development can be discussed in a subsequent chapter.

CHAPTER V.

THE BIRTH AND INFANCY OF RAILWAYS.

The development of the idea of railways was a slow and gradual process, and can be traced back a long way into history. Amongst the ruins of Pompeii on either side of the roadway are slabs of stone on which are marks showing where the cart wheels have constantly passed over. These smooth stoneways made the haulage work of the beasts very much easier.

Similar stoneways were introduced into England hundreds of years ago, and were found to be vastly superior to the ordinary rough roads, as heavier loads could be drawn much more quickly and safely by this means. Even to-day, in many places, use is made of smooth stones to form a way on the ordinary paved roads to assist the hauling of heavy loads up steep inclines.

Before the days of the great road-builders, Macadam and Telford, the common roads were very difficult to maintain in good condition, particularly where there was much heavy traffic, and this led to the idea of placing long planks or timbers at the bottom of the deep ruts instead of constantly filling in with stones. But in the wet seasons

these planks sank deeper and deeper, and so strong oak planks fastened together with cross pieces were afterwards laid on the surface. In a number of instances these timbers were used as special roads, and ran direct from the colliery to the river or canal banks. The heavy coal-carts were fitted with four rollers to suit the planks, and on these simple wooden ways it was found that one horse could draw nearly three times the load hauled on the ordinary rough stone roads. A later development was to place still another plank on top, and the cross pieces were covered with earth to protect them from being broken up by the horses' feet.

Stone and wooden ways as special roads continued to be used until, in the year 1776 (about twenty years after the first canal was cut in England), an iron railroad was made near Sheffield, and thirty years later Parliament gave powers for the construction of a somewhat similar road in Sussex.

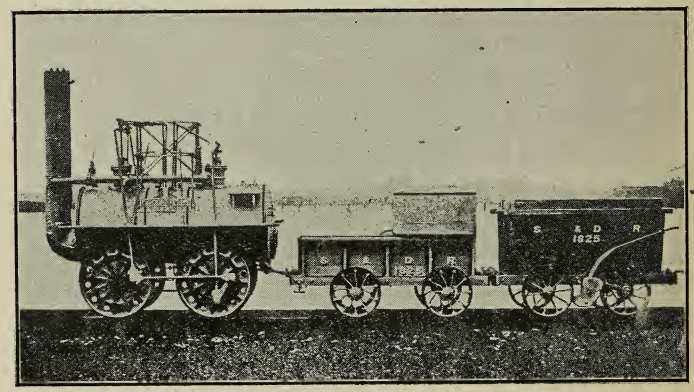
The Birth of the Locomotive.

Great Britain first gave railways to the world, and it was due to the enterprise of British engineers and men of business that the problem of steam locomotion was ultimately overcome. It is true that a steam carriage was driven through the streets of Paris at an early date, but in rounding a sharp corner it overturned and was condemned as dangerous, and the interest of the French

people waned considerably; still, efforts to improve steam locomotion continued in England.

From this time it is a story of great endeavour to find some other and better means of drawing wagons than by horses on roads, tramways and canals. All manner of inventions quickly followed one another.

A stationary engine hauled wagons by means of



Locomotion No. 1, Stockton and Darlington Railway, 1825. The First Engine on the First Public Railway.

cables. One man tried sails, but found they were of no use, especially when there was no wind. Another genius produced a steam horse, the legs of which worked mechanically, and which, the inventor said, would grip the road, but it was a dismal failure, as it exploded and killed several onlookers. Perseverance wins, however, and in 1803 Richard Trevithick built a locomotive which

ran on the Ponydarran iron plateway or tramway, in South Wales. This engine had a fair measure of success, and to Trevithick must be awarded a great deal of the credit for ultimate triumph; in fact he has been spoken of as "the Father of railways."

Cugnot, a French engineer, built a locomotive; Oliver Evans, an American, built a steam carriage, whilst other minds were also busy on the problem. Some of the first British engines tried were hopeless, they were always breaking down and horses had to be sent out to bring the machines home again; the scoffers said the failures were so regular that horses were always turned out when the locomotive went to work in order to save time.

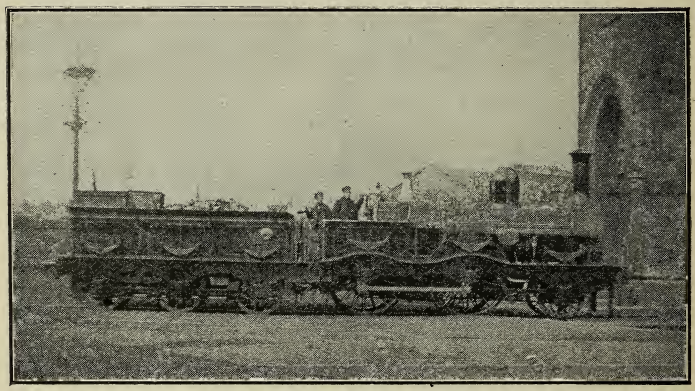
The famous name of "Puffing Billy" was given to one of the first successful locomotives. It worked regularly on a colliery line at Wylam, near Newcastle, in the year 1813, and continued to work for sixty years. "Puffing Billy" is still to be seen in the South Kensington Museum, London.

The First Public Railway in the World.

What to-day is part of the North Eastern Railway, the line which forms the middle link in the East Coast route from London to Scotland, was then known as the Stockton and Darlington line, and this was the first line in the world to provide a public conveyance behind a steam engine. George Stephenson, who had been paying

a great deal of attention to the study of locomotives, and had watched the experiments of others, was appointed Engineer of this railway. His name is familiar throughout the world. For this railway he built "Locomotion No. 1," which hauled the train on the opening day, September 27th, 1825, a date of great historical interest.

A description of the train is interesting. In



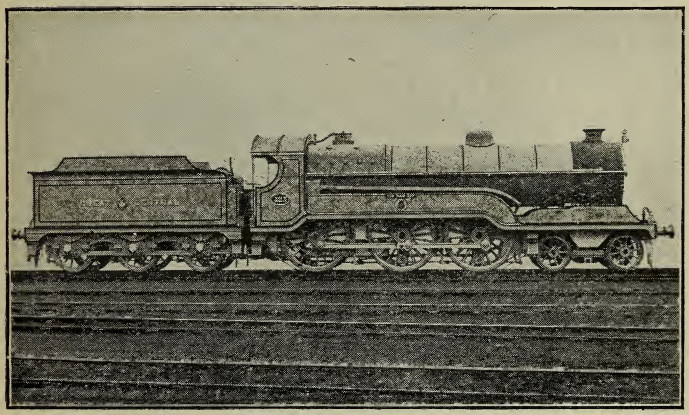
Forty Years Later. 1865.

front a man rode on horseback to make sure that the road was kept clear of obstruction. Next to the engine were six coal trucks, followed by a passenger coach called the "Experiment," which had already been used on the railway drawn by a horse. It was very different from to-day's coaches, as it somewhat resembled a caravan. This coach bore the Directors of the line. More coal trucks followed and completed the novel procession.

Seats had been placed in the wagons, and between 500 and 600 people enjoyed their first trip behind a steam locomotive.

The construction of this railway resulted particularly in the development of the important town of Middlesboro', which was then merely a collection of huts on a mudbank.

Riding in a coach-and-four with postillions and



Present Day Express.

outriders was not the pleasant journey in those days that the highly-coloured pictures of to-day would seem to suggest. The roads, particularly in Lancashire, were in a vile condition, and one writer tells how in a journey of twenty miles on the Liverpool road he saw no less than six carts overturned with the wheel axles broken and the contents scattered about. Some of the ruts in the road were of a great depth, and it was unsafe

to travel, especially when footpads and robbers were ever ready to take advantage.

The water-routes were far from satisfactory, only the Bridgwater Canal with the Rivers Mersey and Irwell connected Liverpool with Manchester,

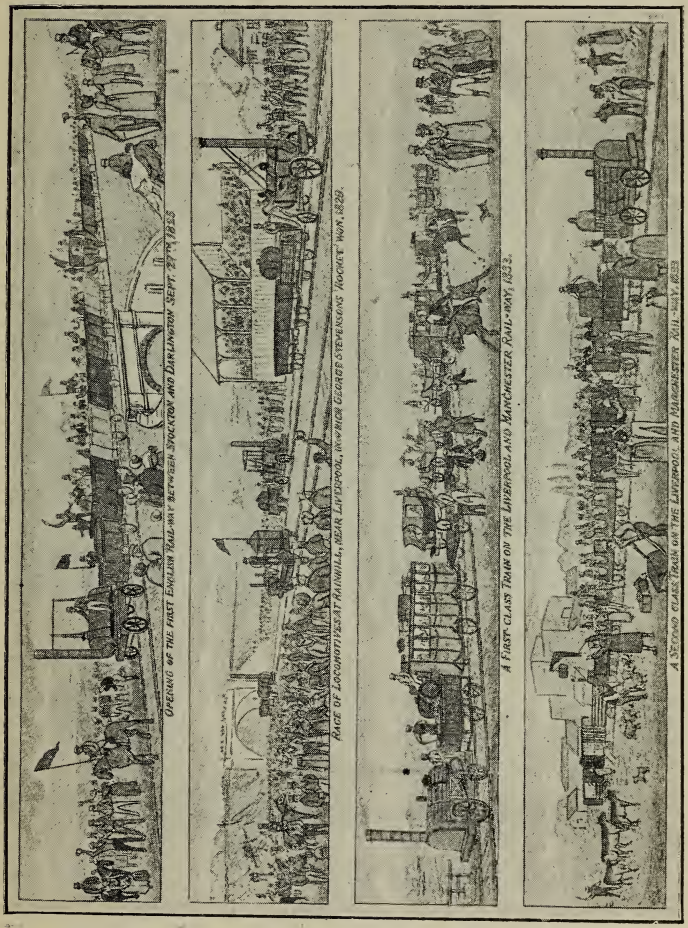
George Stephenson. The Famous Engine Builder.

and it was not to be wondered at, therefore, that a good deal of support was given to a project to build a railroad between the two cities.

A Locomotive Competition.

George Stephenson, who by that time was regarded as an authority upon railways, was

called upon to give an opinion, which he gave in favour of building a railroad across Chat Moss



Sketches of Opening of Liverpool and Manchester Railway, etc.

in Lancashire. The Moss was like a sponge, and it seemed almost impossible to fill it up, in fact it

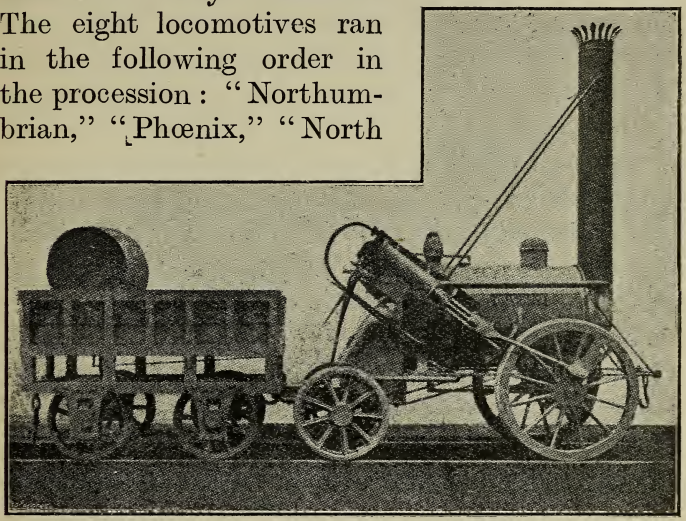
was believed by many to be "bottomless." The work, however, went on, and the appetite of the pit was at last satisfied, a solid foundation was formed, and the construction of the railway progressed.

The kind of power to be utilized for hauling the wagons was a problem, whether horses, cables or locomotives, and one of the Directors suggested a competition with a prize of £500 to the owner of any kind of machine which proved the best for haulage purposes. Rainhill, near Liverpool, was proposed as the spot for the trials, and engineers had to produce their machines and prove their worth during a period of several days before a critical audience. It is well known that George Stephenson entered with his famous steam engine the "Rocket," and won the prize. A number of machines which were being built were not completed in time, and those others which did actually enter the race failed before the finish.

Although the "Rocket" was not the first engine, it proved the great powers of the locomotive and finally settled the question as to what kind of power would become famous in the realm of land transport, which is the reason why so much sentiment is attached to its name.

For the opening of the Manchester and Liverpool Railway, which occurred some months after the trials, the Company turned out the whole of its stock of locomotives and carriages, and amid

great rejoicing eight trains set out from Liverpool, carrying nearly one hundred people in each train. George Stephenson had built seven other engines in time for the opening ceremony, and these were duly christened. The eight locomotives ran in the following order in the procession: "Northumbrian," "Phœnix," "North



The "Rocket."

Star," "Rocket," "Dart," "Arrow," "Comet," "Meteor." It was a great day, and throughout the length and breadth of England and abroad stories were told of the wonderful performances of George Stephenson's engines.

Opposition to Railways.

It must not be thought, however, that every one was immediately satisfied that railways were

"the great invention." There was much opposition. Even engineers believed that the wind would blow the engines backwards, and that the smooth wheels would not grip the rails, but would turn round and round without the train moving forward. Even if the engines travelled at all they would easily be beaten in speed by the slow canal boats said some people, whilst an opinion often expressed was that the weight of the train would send it spinning along and the driver would be unable to stop it. Others feared that engines could not possibly climb hills, and even if a little progress was made they would surely run back again. A German doctor assured the people that it would be impossible for ordinary mortals to watch the trains pass along, they would inevitably go mad. He also predicted that animals would be affected, the cow's milk would turn sour, and suggested huge hoardings along the line side to shut out the sight of trains travelling at the terrific speed of twenty miles per hour!

The farmers and colliery people, too, feared the railway, and vigorously opposed the work of construction, saying that the farms and gardens would be ruined. It was also expected that the common roads would become deserted and covered with grass: all the Inns would have to be closed, and horses would become extinct.

The pace, however, had been set in this country, especially after the Rainhill trials, and the new form of travelling was so enjoyable that the

well-to-do classes had their own private carriages placed on wagons and travelled, partly by railway and partly by road, without using the railway coaches. The carrying of goods and coal was so improved that all colliery owners wanted a steam locomotive, whilst those who had money to invest were anxious to place it in railroad shares.

Many New Railroads.

New railways came into being in a very short time. A railway about six miles long was built between Canterbury and Whitstable. To open out the coalfields and granite quarries in Leicestershire a railroad was laid from the town of Leicester to Swannington. Other railways followed in quick succession. London to Bristol formed an important beginning for the Great Western Railway. A large amount of interest centred round Manchester, where the Manchester and Liverpool Railway had aroused world-wide curiosity. Branches from this line to Wigan and Warrington were undertaken.

The Manchester and Birmingham and the London and Birmingham Railways, which became the London and North Western Line, were soon an accomplished fact, but these railways were only completed after a bitter struggle and enormous expense in buying off the opposition of the landlords who exacted large sums of money for their land from the projectors of railways. Still the

prejudice against railways continued, however, and public meetings were held in almost every district where railways were proposed. But all these prejudices were one by one overcome, and in due time the alarm and excitement of the people calmed down, but the cost to the Shareholders was enormous.

Observers of railways to-day sometimes wonder why certain railways have followed such a roundabout route between two towns when in a number of cases the direct route is by far the simplest and easiest. The answer is to be found in the history of the unflinching opposition of landlords, farmers, doctors, and even clergymen, who determined the railway should pass as far away from their country houses as it was possible to make them. In many cases tunnels had to be bored under hills, and deep cuttings made owing to the owners of the level land on the route refusing to allow any railway to pass over it.

A Mania for Railways.

The pace in railway construction began to grow quicker and in all parts of the country navvies were daily wheeling tons of stone, earth and clay out of the cuttings.

The rush was so great that, comparatively speaking, railways sprang up like mushrooms in the night, and between 1840 and 1846 the whole country went railway mad. It was even proposed

The Railway Systems of Great Britain.

to fill up the canals and turn them into railways. Parliament was doing little else than passing Bills permitting small railways to be undertaken, and in one year alone hundreds of Acts were passed authorizing new lines, but when the mania was at its height the brake was suddenly applied by Parliament, and it afterwards became difficult to obtain sanction to build a railway, without proving the necessity for a new line.

There was also considerable opposition from the Government of the day, which desired to improve the common roads in preference to supporting railroads, but in spite of this opposition the railways grew in number. The railway connecting London with Birmingham was opened in 1838, and during the next two years no less than 321 miles were added to the British railroads, which included the Manchester and Birmingham, Manchester and Leeds, Chester and Crewe and others.

With the development of railways the trade of the country grew enormously, and, what was surprising to the people of the time, the canal boats were loaded with as much as they could carry, and horse-drawn vehicles were never more in demand for work in running to and from the stations. Travel became easier and cheaper, and thousands who never before had set eyes on London were able to make the journey in comfort and security. Foodstuffs were more rapidly conveyed to the towns, and, with a great reduction in

the price of coal, the general rise in the comfort of the poor people was regarded as extraordinary.

Instead of ruining the gardens and crops of the farmers, as had been feared, quite the opposite was the result. Lime, manure and coal were purchased so cheaply and easily that agriculture became more profitable, especially as the produce could be taken to many more markets and carried far greater distances. In eight years after its opening the railway between Manchester and Liverpool carried no less than five million people; so popular had the new form of travelling become.

The very rich people, however, who desired to keep themselves apart from crowds, did not patronize the railways for some time, but still preferred to use their coaches, travelling by the roads, and even Queen Victoria did not make her first railway journey until 1842, twelve years after the Manchester and Liverpool line was opened. Gradually this prejudice disappeared.

The Battle of the Gauges.

All railways were not built to the same plans. George Stephenson believed in constructing a railroad about the same width as that between the wheels of the old carts, and accordingly set the iron rails 4 feet 8½ inches apart. But others had different views and adopted varying widths. Brunel, who was the Engineer for the Great Western Railway, decided that the broader the

line the better, and made a railroad seven feet in width.

Parliament saw that there was a disadvantage in this, as it was not possible for engines, carriages, and wagons built for a broad road to travel on a narrow line or vice versa. The result was that

Great Western Broad Gauge Railway with Rail for Narrow Gauge between.

the Great Western Company placed another rail in between, so that two were only 4 feet 8½ inches apart, but in other sections of the line this had not been done, and all the goods had to be unloaded from one train to another, which soon came to be recognized as a great drawback. There followed a long struggle between rival engineers as to what should be the width of line for the

whole of the great railways, and the supporters of the narrow 4 feet 8½ inches gauge at last won the fight, known as the "Battle of the Gauges," and this afterwards became the standard. The Great Western Company set to work to fall into line, practically every employé being utilized to effect the change, and in a very short time the old seven-feet-wide road disappeared, and this railway installed what is known throughout the world as "the standard gauge."

After the Railway Mania construction quietened down, hundreds of small companies were absorbed by the larger ones, and from these amalgamations great companies were formed—Great Western, London and North Western, Great Eastern, Midland, North Eastern and many others which had consisted of a dozen railways, varying in importance, bearing names now buried in the past.

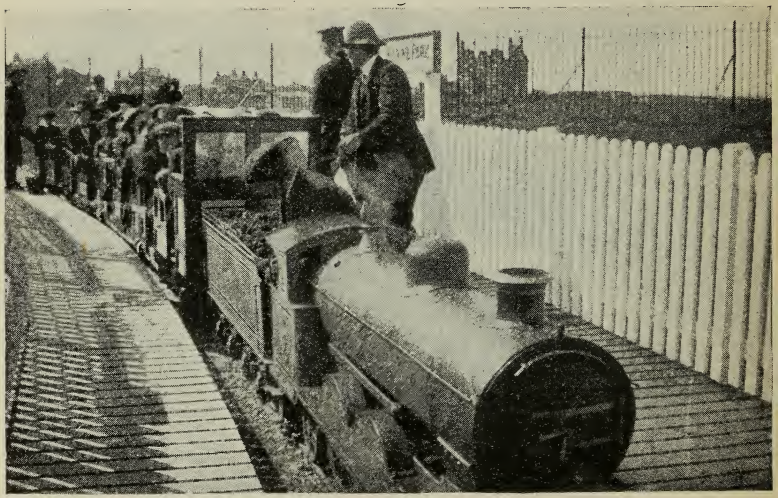
Progress on the railway has been made in all directions; locomotives, carriages, wagons, the railroad, stations, and signalling have been perfected, speeds have increased, and many inventions have been introduced which have materially improved the utilities of the railway as the greatest medium of transport by land.

Britain's "Toy" Railways.

In the British Isles are a number of short railways differing from the great Trunk lines with their powerful engines and large stations. Many

are little more than toys when compared with the mighty railroads starting out of London. With narrow gauge lines, small locomotives, and miniature coaches and wagons they would not appear to the ordinary observer to be of great use in transport work. They do possess, however, considerable utility.

What is their purpose? In some instances



By permission of Messrs. Bassett, Lowke.

One of the "Toys" loading up at the Station.

they are feeders. There are many villages and small seaside places in this country with which the large railway companies have no direct connection; and it would certainly not be worth the expense to lay a branch railroad and run costly locomotives to small places where the traffic

obtained would be scarcely sufficient to pay for the coal burnt in the engine firebox and the cost of maintaining the line. The carrying of passengers to and from some of these small seaside places or intermediate resorts to the main railway line, or to a not far distant town, is performed by very light railways which are not expensive to construct or to operate. They also provide a means for farmers to transport their grain and cattle to the market towns.

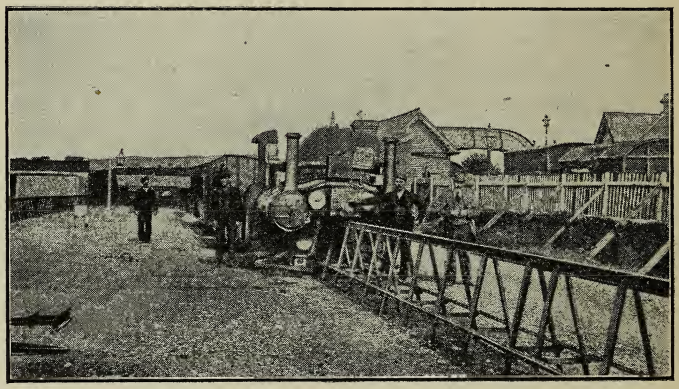
These light railways have assisted in developing industries in a new locality by bringing iron ore to the blast furnaces and enabling new collieries and quarries to send their products to the seaports.

Some of the small engines, coaches and wagons are built from the latest models, and although from a photograph the locomotives appear veritable giants, yet when seen in reality the onlooker has the feeling that one of them could be tucked under the arm and easily carried away.

Although small yet they are powerful, and haul a trainload of people or minerals at a fair speed, thus playing an important part in transportation. Light railways, from the toy models to the larger systems, will continue to grow in number, spreading out to places which hitherto have been far removed from the railway, until every small village can boast of railroad facilities.

Special mention should be made of one peculiar light railway hidden away in the south-west corner of Ireland. Its real name is the Listowel

and Ballybunion Railway, and is the only one of its kind in the British Isles. Some visitors have nicknamed it the "three legged," and others the "one legged" railway. It has only one rail mounted on upright trestles which are varied in



The "Three Legged" Engine.

height to allow of the little railway running along large sandhills without having to cut a way through them. It is a novel method of overcoming difficulties in the rise and fall of the land and, in many places, resembles a switchback.

CHAPTER VI.

THE LANGUAGE OF RAILWAY SIGNALLING.

There are many forms of language, not only the languages of speech, but also the language of signs. Those unfortunate people who are deaf or dumb are forced to explain their thoughts and desires by means of signs. The telegraph instruments tick out messages to far-away operators. There is a language of the trees and flowers which tells by unmistakable signs of the approach of spring or the coming of winter. In the Army flags, shutters, discs and daylight lamps are used to despatch messages, whilst rockets, flares and lamps take their places at night.

Railway signalling is no less interesting and complete a language. Its principal object is to inform the enginemen on the trains whether they are to go forward or stop, and which particular track or route they are to take with their trains. The main idea is to obtain safety for the trains passing over the railway, but railway signalling has also other important uses. With an efficient system of signalling it is possible to work a much greater number of trains over a stretch of line in

one day than could possibly have been dreamed of before its introduction. Reliable signalling enables the trains to be run at considerably higher speeds.

The Beginning of Railway Signalling.

In the early days of railways there were no signal posts along the side of the railway lines, just as there were no signals along the roads, the rivers, or the canals. The trains were scheduled to start from a station at a certain hour, and were also expected to arrive at the end of the journey at the hour of the day printed in the very small time-tables. As the trains were few in number and the periods between them were so long there was very little fear of a collision taking place.

Railway Policemen.

The drivers could always rely on some assistance from the railway policemen who, in their white trousers and top hats, patrolled the lines at detailed points to protect them from damage by trespassers, looking after their beats just in the same manner as the policemen do on the streets and roads of the towns and villages. In the event of anything out of the ordinary occurring, such as a train breaking down or an accident, these point-policemen would go to meet the following train and hold up a danger signal, a red flag in the daytime and a red light at night. When the

driver had brought his train to a halt the policeman would tell the story of what had happened, and then the train would have to stand until the policeman was able to say that the line ahead was clear once more.

The Time Interval system was next tried, which required that no train should be allowed to go forward until the one in front had been permitted a fair margin. It, however, was so difficult to decide what should be regarded as a reasonable margin of time between trains, to guarantee safety, that some other means had to be found.

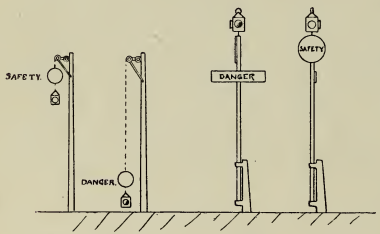
The railway policemen were not altogether satisfactory as signalmen, particularly at night, and so the coloured night-lights came to be fastened on a post, high up so that the driver could easily see them and make no mistake about the colour. There were three colours, and the people used to say—

> "White is right,
> Red is wrong,
> Green is gently go along."

A light by day was of course useless, and many peculiar signs were tried. First, a ball arrangement, as an experiment, was used on one railway. If this ball was hoisted on the top of the pole it denoted "right ahead," but if no ball was to be seen, it spoke of danger, and clearly indicated to the driver "thus far shalt thou go and no farther."

More Experiments.

The Great Western Railway in its early days tried a kite signal. For "danger" a screen was hung across an iron framework, fixed to a post, and drawn back to show "safety." Baskets fastened to the tops of posts were also tried as well as coloured flags, but none of these was successful, as it can easily be realized that on a warm summer's day when there was not a breath of wind the flags would hang limply down and could scarcely be understood.

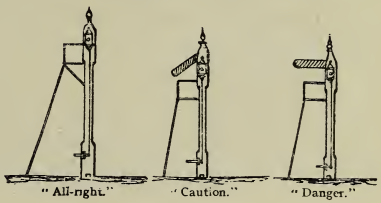


BALL SIGNALS. BOARD and DISC SIGNALS.

An idea which gained more approval was the fixing of a movable crosspiece to the post. The crossbar had the word "danger" painted on it, but if there was no danger it could be swung round pointing edgewise so that the driver could not see it, and a large round disc came round to the front in its place on which was plainly written "safety." Immediately the train passed the signal it was turned again to "danger," and was not again altered until the train had almost arrived at its next stopping place, which in those times was a good distance away.

"Semaphores."

The greatest advance came in 1842 with the introduction of what is called the "semaphore" signal. A semaphore is a "mast with arms," hence the use of the word in connection with flag-signalling adopted in the Army, and by the Boy Scouts, the body being likened to the mast or post. The arm is horizontal for "danger" and inclined downwards at an angle of 45 degrees for "safety." The semaphore signals quickly came to be recognized as the most reliable type of signal, and were generally used in a very short time.



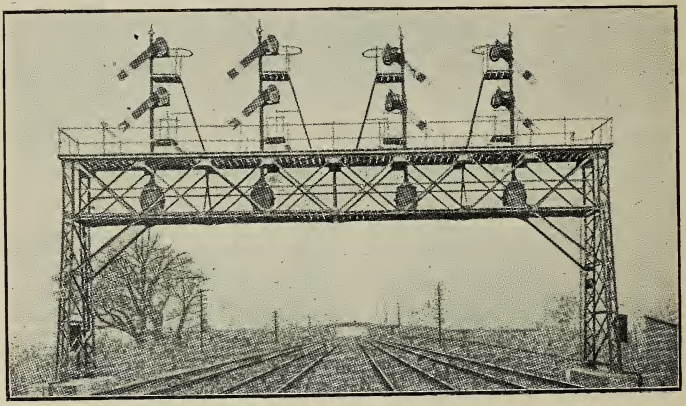
The First Semaphores.

On small country platforms there are still to be observed levers, forming a small frame, for working the signals and points near the station; there is no signal-box. This was formerly the general rule, although the levers were first placed at the bottom of the posts, but afterwards all together in one spot on the ground. As there was no protection for the men it was decided to place all the levers for one stretch of line in wooden huts which came to be known as signal-boxes.

In some instances the boxes had to be built to a good height, regular "sky scrapers" in fact, in order that the men could have a good view

of the line over bridges and see clearly all the signals and the trains as they approached.

The signal posts too had to be of different heights for the convenience of the driver. Tall before or behind a bridge, so that the men on the engine could easily pick them out as they travelled



Signals are Elevated to give a Good View.

towards them. In cuttings, or where the signals were placed level with the walls of the bridges, a white painted board placed behind made them more easily observed.

The Electric Telegraph.

The introduction of special electric telegraph instruments into signal boxes has been of great assistance in improving the methods of railway signalling. The Great Western nearly eighty

years ago utilized the telegraph on their railway to assist the signalmen in their work, and little dialogues went on between the signalmen on these instruments, which prove how valuable was the telegraph even in the early days. One signalman telegraphs "Goods train coming here," receiving in reply, "All right, let her come forward;" and a little later "Passenger train is approaching," receiving perhaps in answer, "Hold her back, goods not arrived at my box yet." These telegraphic conversations assisted signalmen to properly locate trains, and greatly reduced any danger of collision.

As the number of trains increased it was discovered that there was nothing to prevent a forgetful signalman from pulling off two signals, in mistake, one for the main line and another from the branch line, thus allowing two trains to travel in the same direction towards the same point with the result that often a collision occurred.

A man named Baxter reduced this danger by bringing out a patent to lock signal levers, so that having pulled off one signal the man could not pull off another and so permit two trains to converge towards the same point. The former must be replaced at "danger" before the second is lowered.

The line now is divided into sections, called "block" sections, and one signalman in his box has charge of one block. A peep inside a box, say at a small country station, showing the man at his work is full of interest.

Inside a Signal Box.

There are a number of iron levers on which are small printed numbers, and the signalman sitting quietly on his locker, prepared for a call, understands the signals and switches which these levers control. On a shelf above the frame of levers are four round objects very much like alarm clocks or aneroid barometers, two for the Up line and two for the Down, and by the side are the important bells. These bells talk to the signalman during the day and in the long hours of the night.

The bell suddenly rings once, to call attention, and the signalman quickly gets up and taps back. The bell rings four times—three times quickly, a pause followed by one more, and four taps in the same manner are given in reply. He knows the bell language which, in this instance, says, "Are you ready to accept slow passenger train?" and turning a handle, moves a little pointer in a clock-faced indicator. This serves to remind him that by repeating the bell signal he has accepted a train and must not take another until he has passed the passenger train forward to the signalman in the next block section. He then offers the train to the signalman in advance of his box. Two more taps on the bell from the rear box inform him that the train is entering his section, and he again moves the pointer to a spot on the "face" which tells him that this train is on the

line coming towards his box. These indicators are connected by electric wires with the indicators in the other signal box, and when the man moves the pointer it acts in both boxes at once.

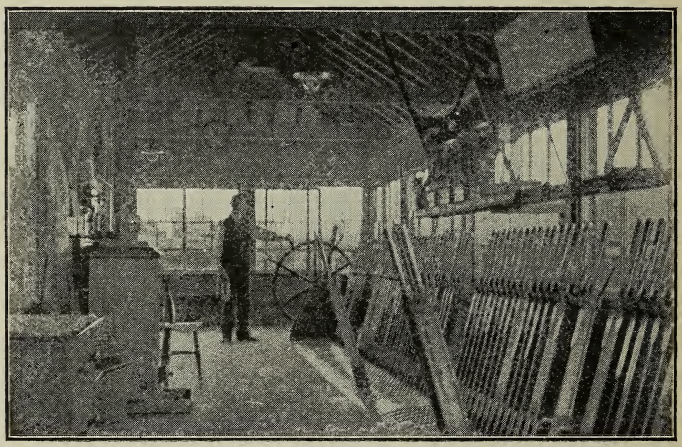
Station Bells and Crossing Gates.

He now tugs away at a rope which causes a bell, suspended outside the box, to clang loudly. At one time bells were rung at all stations in this country to inform travellers of the near approach of train time, but the practice is now fast dying out, and only remains at some of the small wayside stations.

Here are gates across the lines at a point where the footroad crosses over, and his next duty is to turn the gates to close the public road and open the railroad. A large wheel in the box supplies him with the means of doing this. All crossing gates are not of course near to signal boxes, and gatemen in many places have to be provided for this work. These men usually live in small houses on the spot, and are brought out for their work by the ringing of a bell fixed in the house, or on the gate. The signalmen on duty press the buttons in the boxes to ring the bells and warn the gatemen that a train requires a clear path. Alterations to the railroad are constantly being made in England to reduce the number of level crossing places, as they are a source of danger, and in some instances the ordinary roads have been

lowered to run under the line and in others carried over by a bridge. Level Crossings are more numerous in America than in England, and in some towns the trains actually run through important streets.

When the gates are right the signalman can



In the Signal Box. Ready to Close the Gates.

pull off the signals. There is a clear road, so he lowers all three.

Describing the Signals.

The first which the driver will reach is called the "distant." This signal differs from the others in that it has a piece cut out of the end of the arm, like the tail of a fish. Some of these "fish tails"

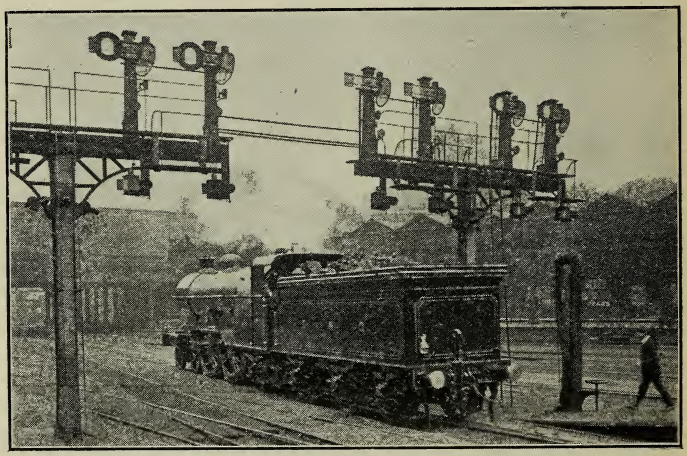
are illuminated at night to make them distinctive. The "distant" is the only signal which a driver is allowed to pass when it shows a red light or the signal arm is in the danger position ; it is only a warning signal, and explains to the watching driver what he may expect at the next signal.

The "Fish-tailed" Distant showing "All Clear."

The second is the "home" signal, passed before the box is reached, which means that the train has arrived at the end of the section, and the men in charge must be ready for all emergencies. If the signal is down the passenger train slowly rumbles by the box and into the station.

Meanwhile the signalman has gone through a

similar performance in the bell language with the man in the box further along the line, who, having previously given satisfactory replies, does nothing to hinder the train from continuing its journey. The third signal, known as the "starter," is lowered, and entering another section the driver knows his way is safe to the next home signal.



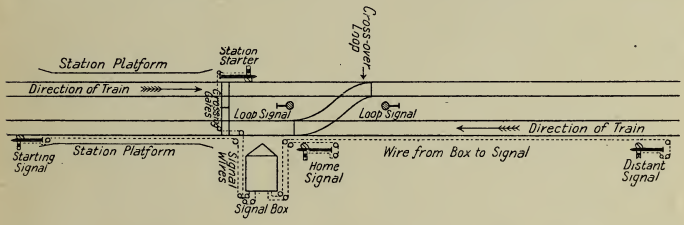
Starting Signals at the Station Platform. Separate Signals for the Different Roads.

When the train has passed the signal box and drawn up to the station platform all that remains for the signalman to do is to inform the signalman in front by giving two rings that the train is travelling in his direction, and to advise the box in the rear that his line is once more clear. This latter he does by ringing twice, a pause, then one

more ring, and releasing the indicator needle to its normal position. All these bell signals must be repeated by the signalman receiving them.

Other Bell Signals.

A great deal of work is performed with the assistance of those small bells resting on the box shelf. There is a different code for all the different kinds of trains—express passenger, slow passenger, express goods, slow goods, light engines and empty trains. The telegraph bell is also used for other



Sketch shewing signalling arrangements at a small station.

messages, which might be described as safety calls to assist in avoiding or for reporting disasters to trains. Anything unusual happening to a train is quickly known to the other signalmen on either side. Such matters as a train divided, an obstruction on the line, a wagon on fire, a plank dangerously overhanging the side of a wagon, or a passenger in a compartment making signals of distress, are provided for in the signalman's bell code.

There are other little details of interest in a signal box to help the man in charge. In some places, small indicators containing a model of a signal are installed. When the signalman pulls over a lever, which controls a signal he cannot see from his window, the little signal arm on the indicator will work with the real signal, and the signalman then knows whether or not the semaphore arm out on the line has dropped into position. Little indicators, too, show whether the lights of these signals at night are burning, and so the signalman need never be uneasy when there is a strong wind blowing; he will know if the light goes out.

Signalling in Foggy Weather.

In foggy weather the signalman must have assistance. In former times the fogmen were called out and remained by the signal, placing two or three fog-signals on the rail for stop, and one for caution. When the snow was on the ground special detonators were nailed down so that the snow-sweepers on the engine could not brush them off.

Men now required for fog-signalling are summoned out at all hours by electric bells which are fixed in their houses. At work the men are sheltered in little sentry-boxes beside the line, and can place fog-signals on the rails almost without leaving their little shelters. By pulling a lever a little arm fastens on a fog-signal and places it on the

line, and pushing the lever back again knocks it off either before or after it has been exploded by the engine wheels.

Small wooden arms were at one time fastened to telegraph poles to guide the driver in foggy weather as to his distance from a station, but this practice has long since been discontinued.

The Latest Improvements.

There have been numerous signalling improvements in recent years, and in a number of places the old signals which were pulled off by a lever attached to a wire can be released by electric or pneumatic power. The men in these boxes need no more strain their muscles to pull down a signal arm some hundreds of yards away, as a small hand-lever, which a boy can easily work, quickly performs the operation, and the trains themselves, with the aid of electricity replace the signal in the danger position.

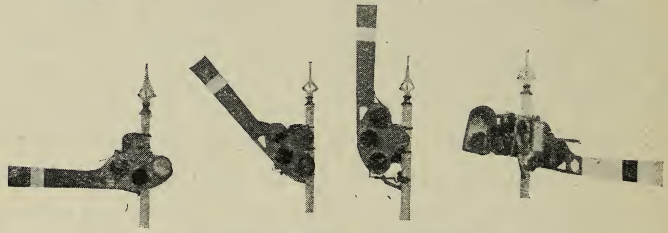
Upper Quadrant or "Three-Position" Signals.

The "three-position" signals are an elaborate re-introduction of the old white, red, and green signal lights of the early railway days.

On the steam railways in Britain this system is largely in the experimental stage, only being used upon certain special sections of one or two railways.

As shown in the photograph, the horizontal position or red light indicates "danger," the intermediate position at 45 degrees with an orange light "caution," and the arm when vertical showing a green light denotes "all right."

The wide lift bridge over the River Trent at Keadby on the Great Central Railway, shown in the illustration, necessitates the greatest precautions being taken to safeguard the trains



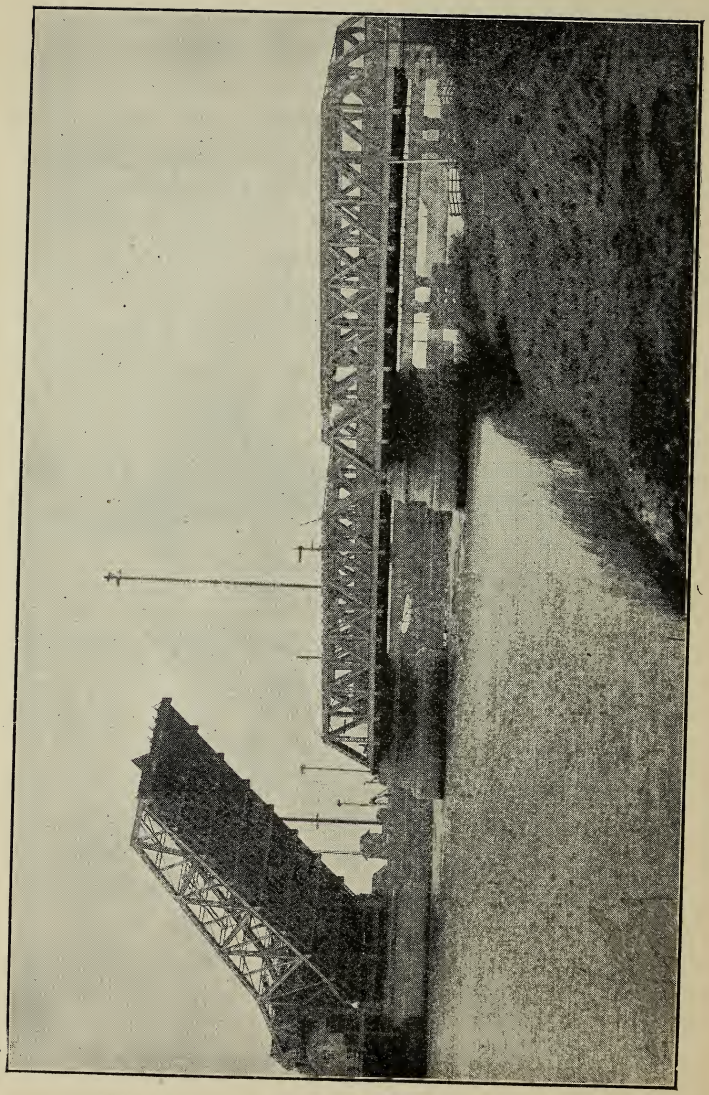
"Three-Position" Signals.

travelling in this section to prevent the possibility of an accident occurring when any portion of the bridge is lifted.

The electrically operated "three-position" signals are considered as the most reliable protection as here they provide the engineman with adequate warning, and are infinitely superior for such a purpose to the ordinary two-position signals in general use. In addition to the protection afforded by the "caution" signal, sand drags (see Chapter X.) are installed, into which the train would automatically turn in the event of danger signals being passed when the bridge is lifted.

There appear to be very few shortcomings in present-day signalling, and the chances of an accident are very few. Without signalling the railway system would be helpless, it would be like the human body without a nervous system, deaf, dumb and blind, but the mechanical, pneumatic and electric systems now in use are excellent, and enable British railways to live up to the watchword of "speed with safety."

A signalman works in solitary loneliness, but he has much to occupy his mind. He knows that a great deal depends upon him and that he is master of the situation. The fact that there are so few serious accidents is sufficient proof that he is alive to the responsibilities of his position.



The huge Lift Bridge over the Trent at Keadby.

CHAPTER VII.

KEEPING THE RAILROAD IN GOOD CONDITION.

The first step in the making of a new railway or a branch of an existing railway is taken by the railroad Engineer, who makes a survey of the land through which it is proposed to cut the line. He decides from his observations which of several routes is the best. The next business is to take the levels and work out the probable amount of cutting necessary and the heights of the embankments required. Upon the Engineer rests the responsibility for the weights and strengths of bridges, and also for estimating the quantities of iron, brick, stone and timber required.

A firm of railway contractors is usually entrusted with the work of cutting new lines, as they possess big machines known as steam navvies for scooping out the earth from embankments, and small locomotive engines and special wagons for clearing it away. Moreover, the railway companies are not usually in a position to spare the large number of men necessary for such big undertakings, as their staffs are needed for carrying out the repairs to the existing railway.

It has been shown that signalling exercises a great influence upon the safety of railway travel, but it is not alone responsible. There are other factors to be taken into consideration. Keeping the road itself in good condition is a very important work.

The Platelayer's Work.

Gangs of men called platelayers, each gang usually composed of about five men, are set apart to look after a particular length of the line. The man in charge is termed "Ganger." Their duty is to inspect the line each day and attend to any small repairs required. They can often be seen walking slowly in Indian file by the side of the track, one of the party swinging along with a bag of tools slung over his shoulder.

The Ganger has a "keen eye" and can very quickly discover any defects in the railroad, and when he notices anything which requires attention waits for the "tool bagman" to draw up. If he considers the rails have sunk a little, forming a dip in the road, down he goes on his hands and knees to make sure, glancing along the metals to find the exact spot.

He points this out and the rail is lifted while others beat the stone ballast under the sleepers to pack up the road till he calls out "Hold."

The wooden blocks, known as keys, which lock

the rails in the chairs[1] often work loose and sometimes drop out altogether. The platelayer with his long-shafted hammer knocks these tightly into place again, and if any are found to be of no further use new ones are taken from the bag and put in their stead.

In the course of their tramping along the line perhaps a fast train drawn by a giant engine will rattle past at a great speed. It is surprising the effect on the railroad of the passing of heavy expresses. The Ganger will again drop on "all fours," and what to the ordinary observer is a straight line of metals, to this man is now shown to be nothing of the kind. The pressure of the locomotive wheels from inside has forced the sleepers slightly from their place so that the rails look zig-zagged to the expert eye. Railway lines which are not perfectly straight may be quite safe for slow traffic, but greater attention must be given to that portion of the roadway along which trains travel at very high speeds.

Answering to the call of the Ganger the platelayers bring out crowbars and, digging them into the ground, press the rails and sleepers backward or forward until the Ganger is satisfied they are true in line.

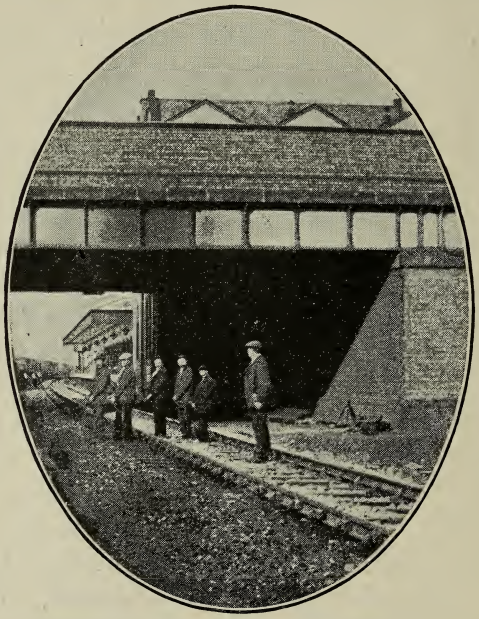
Working in Tunnels and other Duties.

The wearing out of the railway lines in long tunnels is more rapid than outside in the open

[1] The chairs are fastened to the sleepers, and are so called because the rail sits in them.

air. An accident in such a place would be a serious business, and if the tunnel were on a busy stretch of line the interference with train working would be great.

Constant attention to the tunnel railroad is



Pulling in the Road with Crowbars.

therefore essential, and men with flare-lamps must tramp through to carry out their examinations and repairs. These men have to watch carefully for trains when inside these tunnels, and to safeguard them manholes, like cupboards, the size of a small room, are built in the tunnel

walls in which the men can take refuge when trains enter the tunnel. Doors to these manholes keep out a good deal of the smoke.

As a measure of protection for platelayers working in long tunnels an audible warning device has been fixed by one railway company. When an incoming train approaches the tunnel entrance the wheels depress a bar close to the metals. The result of this, by means of electricity, is to set several hammers striking on iron piping which runs the whole length of the tunnel wall. The sound is distinctive and the hammers continue to strike until the train wheels depress another bar on leaving the tunnel.

The platelayers have also the railway banks, fences and drains to look after, and must also keep the permanent way clean and tidy. If there is an accumulation of dirt in the drains at the line side it is scooped out. The hedges are regularly clipped, and in the summer the grass on the banks is closely cropped so as to avoid fires being started by sparks from the engines.

The platelayers gather up waste and cloths which have been used by the drivers and firemen on the footplate, examine the fences and report any broken parts through which cattle might stray on to the railway.

In addition to keeping the road in order, the platelayers also carry out some of the duties of the old "point policemen" by keeping a sharp look-out for trespassers on the railway.

In order to encourage the men to excel in their work many of the Railway Companies distribute prizes to the members of the plate-laying gang whose section of the track is judged to have been maintained in the best condition during the year.

Renewing the Worn-out Road.

The railway lines will not, of course, last for ever, and there comes a time when the old metals must be removed and consigned to the scrap heap.

Before the actual work of transferring from old to new can be commenced, everything necessary for the work must be prepared. What is called the "ballast train" first makes a number of journeys to the spot carrying wooden sleepers, rails and cast-iron chairs and all the other necessary material. A number of men are then occupied for some time at the line side in fastening the chairs to the sleepers with spikes. When this work is completed the change can be carried out.

Very often it happens that there is a good number of trains running in this particular section of the line, too many to admit of traffic being interrupted for relaying purposes during the week, and it means that the work has then to be carried out on Sunday.

Only one running road can be disturbed at one time, and whilst one of them is being renewed the parallel line is called upon to carry all the traffic

travelling in both directions, desiring to pass during this particular day, and what is known as "single line working"[1] is put into operation. Men are posted at each end of the section to protect the workmen and give warning of the approach of trains. Their duty is to use green and red flags and put down fog-signals to warn drivers that they are approaching a spot where caution is needed.

The Transformation Scene.

The relaying gang, composed perhaps of from forty to fifty men, arrives in the ballast train very early in the morning, for the work has to be completed before nightfall. Although it is difficult to work at a high speed on hot days, summer is chosen because of the drier weather and the longer days.

No time is lost in setting to work. Most of the stone ballast has been removed from between the rails during the preceding week-days, and everything is straightforward. There is no rushing hither and thither, no babel of voices or confusion. Everything is quite orderly, and the onlooker is struck by the method and discipline. Each man has his allotted duties.

First come the men who knock out the wooden keys which tighten the rails in the chairs. Afterwards follow the men who unscrew and remove the

[1] See also Chapter XII, "Accidents on the Railway."

Taking away the Old Sleepers.

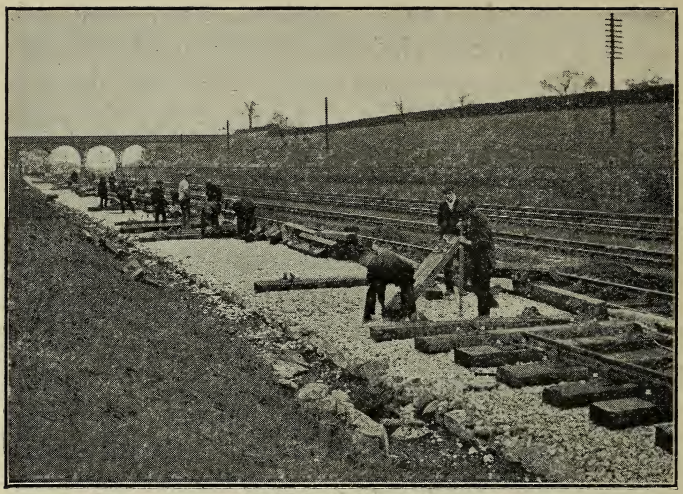
Trimming up the Old Bed.

plates joining two rails together. Two men with crowbars turn out the rails from the chairs and another section removes them. The old sleepers are turned over and taken away. The old road has disappeared. Bring in the new.

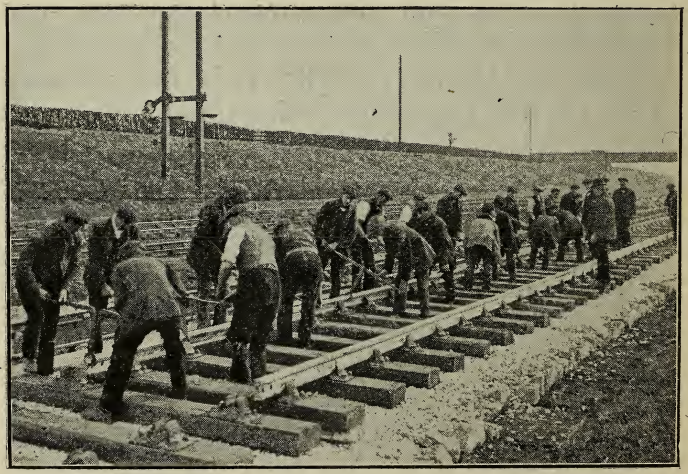
Quickly men are on the spot with shovels levelling up the earth on which the old sleepers lay, and the new sleepers are already being carried from the line side to their "bed." They are placed squarely in position so they shall sleep soundly; it is desired that they shall not be disturbed. The chairs having already been spiked and screwed to the sleepers, the resting-place of the rails is complete. They are dropped into the seats of the chairs, the plates joining the rails together are bolted into place, men hammer home the keys, and Hey presto! the new road is in.

How methodical! The re-laying foreman stands by, and as a rail is being lifted and carried forward cries out, "Down; catch hold; lift; forward; 1, 2, 3, 4, lower." The men move forward like a military squad.

When the time for the midday meal arrives the men troop off to the waiting ballast train and quickly disappearing inside dispose of the food they have brought along with them. If it is fine and dry, very shortly afterwards many of the men may be seen lying at full length on the railway embankment with caps over their faces, fast asleep, and until the foreman blows his



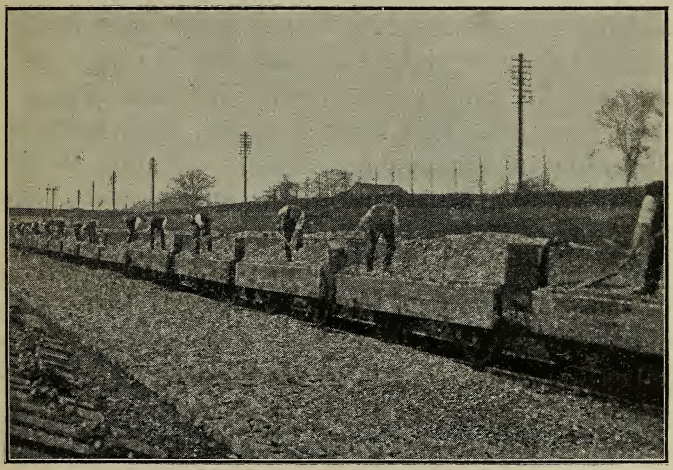
Putting down the New Sleepers and Chairs on a New Bed.



Dropping the Rails in the Chairs.

whistle to recommence work, nothing will disturb them.

In the afternoon the ballast train comes along the parallel line, and the side doors of the wagons are dropped down. As the train moves slowly



Shovelling out the Ballast.

past, the men, standing in the wagons and at the side of the train, shovel out the stones, or slag, as it is called, which is quickly packed under and between the sleepers to make the bed more comfortable and secure.

The Final Touches.

There still remains the straightening or lining of the road, and some of the men stand to the

rails with crowbars to pull in the direction indicated by the foreman. The word of command is somewhat strange. The men insert the bars, and then for some time along the length can be heard the call "A—hoy." The first syllable is a warning to be ready, and is long drawn out, and on the second every man pulls with a will. Where the men picked up this cry it is not very difficult to guess; no doubt it came from a platelayer who had been a sailor, for there are all kinds in the gang—English, Scotch, Welsh, Irish, Americans, Canadians and Blacks—but the Irishmen often are in the majority.

As the red ball of the sun is fast disappearing in the west the work is finished, and tired men, who a short time before heard the tolling of the bell calling worshippers to church, now climb, with their tools, into the ballast train, which is to take them away from the scene of their labours. But there is now a better road, and it is a great contribution to efficient transport.

CHAPTER VIII.

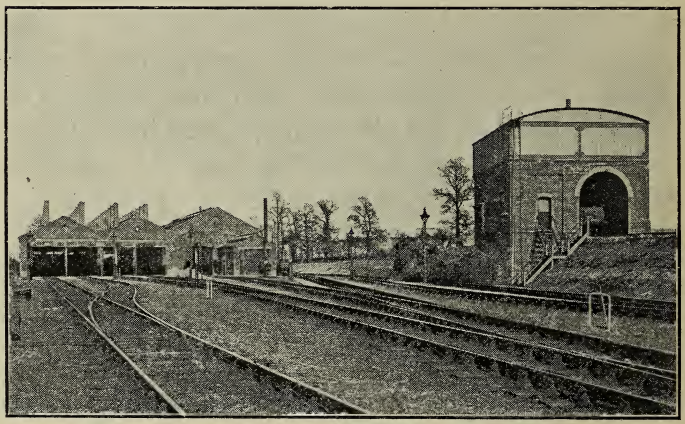
THE TRAINING AND DUTIES OF AN ENGINE DRIVER.

One of the most fascinating employments in the country is in connection with the working of railways, and in all the different sections there is none so alluring as "footplate" work, that is to say, the work of a driver or fireman in the cab of the engine, commonly known as the footplate.

What could be more exciting than to have charge of an express train, which races over probably two hundred miles of country in about four hours, loaded with from three to four hundred passengers, and to know that the safety of all those human lives depends upon the careful working and the sharp look-out of the men in charge of the locomotive? To mistake a signal may result in the express crashing into another train standing on the same line, or it may involve the running through junction points, which probably means that the train is thrown down an embankment, the coaches all piled one on top of the other, badly smashed, many people lose their lives and others receive severe injuries. There is a great deal more which the driver and

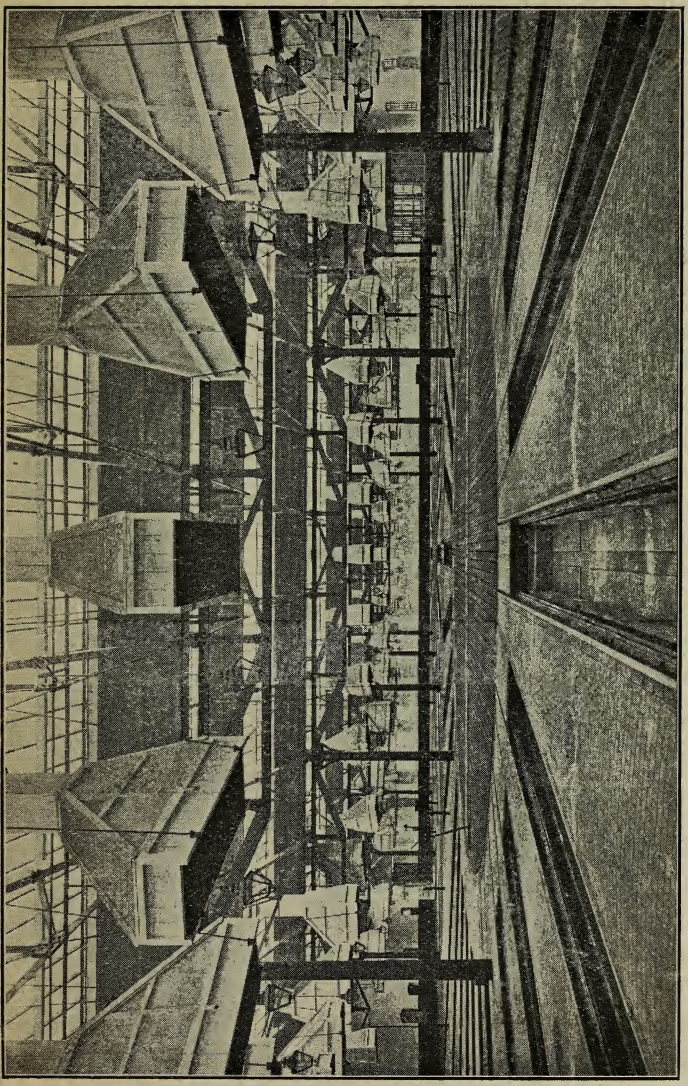
his mate must observe and guard against, of which passengers, in comfortable coaches travelling at high speeds, think or know very little; but of this more can be told in later pages.

Before an engineman is given the responsibility of driving a locomotive he has to work up to the position by years of experience in various jobs



The Engine Shed. Outside the Home of the Locomotive.

inside what is known as a Locomotive Running Shed. There are two special designs of sheds, one class is known as "Round Houses." These "Round Houses" are circular buildings, with all the lines in the shed running towards a turntable in the centre. The other is an oblong building with a number of parallel lines running from one end to the other with pits below, so that the underneath parts of the locomotives can be



Inside a Round House. Showing the Turntable in Centre and Pits to enable Mechanics to work underneath the Engine.

easily cleaned and repaired. The first kind of shed is now seldom built in this country, but more largely adopted in the United States.

These Running Sheds may be called the "resting places" of the engines: they are their homes. When the work for the night or day is finished, here they are brought to stand under cover until again required.

This is where the boy straight from school comes into actual contact with the engines, one of which some day he hopes to drive.

His earliest duties no doubt are very humble. He must make himself generally useful about the shed. First of all he may be told to go to various engines along with a boilermaker. Slipping through the small firehole into the empty firegrate he will take out the old and worn firebars to the instructions of the mechanic, and put new ones in their stead. He is designated Bar-boy.

"Knocking-up" the Drivers and Firemen.

As a caller-up his services are very useful. It is essential that drivers and firemen should arrive at the shed in good time before they are due to take out engines to work their trains, and to avoid any risk of the men oversleeping, the calling-up boy must find his way to the homes or lodgings and make sure they are preparing for work. During rough weather this is not always an enviable task. The caller-up must trudge through

sleet, snow, or rain to his destination, where he may have difficulty in getting an answer to his rappings on the door, but he must not leave until he is positive that his men are preparing to turn out. In a number of cases bicycles have been provided for these boys, especially where men have to be called who live a good distance from the shed.

At night as he slips out of the engine shed and along the yard towards the street he passes one of these giant engines standing like a shadowy sentinel waiting further orders, but he soon becomes familiar with tramping alone in the dark, and learns to be very cautious of tripping over rails, and goes his way with no fear of dark shadows troubling him. He returns to the shed generally cheerful and whistling, and is ready for the next journey when called upon. Sitting in the office, perhaps drying his coat and warming himself after a wet tramp, he listens to the telephone conversations, and again picks up useful tit-bits of information, or he answers the telephone and hears that the driver and fireman of a certain train have been on duty a long number of hours and will shortly want relieving. The relief chargeman tells him the names of a driver and fireman, who are in the enginemen's room close by, and away he goes to bring them along to receive instructions for relieving two of their mates on the road who are needing rest.

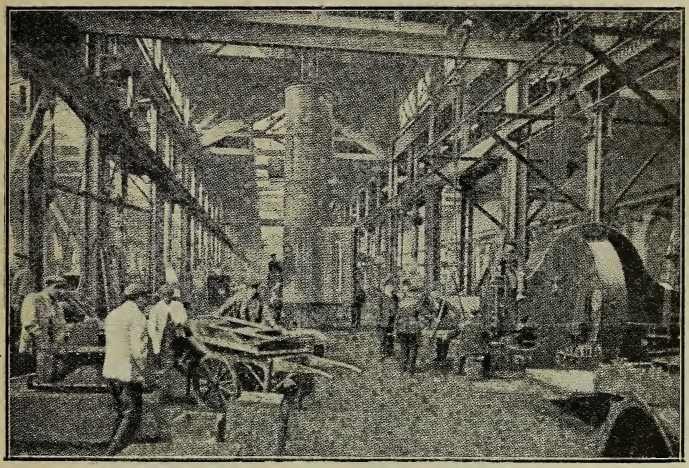
The young caller-up thus obtains a good

knowledge of the district in the neighbourhood of the shed, and a few more important details, but he learns something of greater value than this: his experience is teaching him that if some day he is to become a reliable driver, and his train is always to start on time, punctuality with him must be "the soul of business."

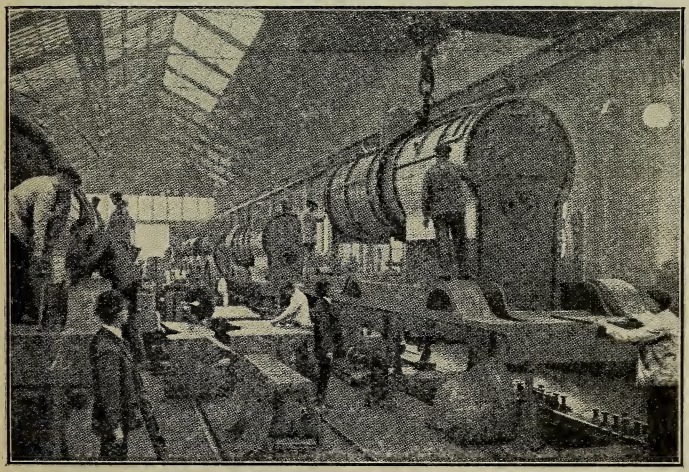
Other Shed Duties.

His foreman will further vary his duties and give him a turn at fire-lighting. In the firebox, where he previously put the new bars, he must now make a fire in order that the water in the boiler can be heated to generate the steam necessary for driving the engine. First of all he must make sure there is water in the boiler, and then place coal in the firebox about six inches in depth all round. Bringing shovelfuls of burning coals from the fire-lighting furnace, he throws these into the firebox, and from time to time feeds the fire with coal from the engine tender until the driver and fireman arrive to take charge and release him for other work.

In moving about the shed he will observe men, in long mackintosh coats, sou'westers and high leggings, washing out the boilers of the engines with hose pipes, sending water at high pressure against the insides to remove the dirt or sediment; others are raking out ashes from the grates, and the skilled mechanics are busy carrying out repairs



Lifting the Engine Boiler.



Fitting the Locomotive together after Repairs.

The Caller-up sees the Engines in Hospital.

to engines which have been lamed or have fallen sick and require attention.

Outside in the yard he will help the coalmen to fill the tops of the engine tenders with coal, working, perhaps, a small crane, which lifts a

Taking the Engine for Coal to the Stage.

large iron bucket to and from the coal wagons and engine tenders.

When he has performed these various duties for some little time he is naturally anxious to try others which will bring him nearer to his main object—engine driving. He speaks to his Superintendent telling him of his desire, and arrangements are made for him to undergo an examination.

First of all his height is measured; he must be five feet six inches, or show promise of reaching that height, as short men in modern locomotives are at a great disadvantage, not being able to see through the cab windows easily, or to reach, without effort, the various levers and handles. The railway company's medical officer must also certify him as physically fit. Afterwards his most important test is set: no matter how well he has done at school, whatever honours he may have earned as a student, or however good a railway servant he may already have proved himself, if he fails in the eyesight test his future possibilities of taking charge of one of these giant engines are gone. Great importance is attached to this test, for if a short-sighted or colour-blind driver has charge of a train there is grave danger of disaster, as he might possibly mistake a danger signal for an "all clear," or dash into some obstruction on the rails. In America the trainmen are permitted to wear plain glass goggles, but this is on account of the dust blown from the great prairies and not to assist men with poor eyesight.

English drivers and firemen are not allowed to wear glasses, so with the naked eye he must count correctly the number of dots on a card shown from a distance, and must correctly name various colours. If he is neither short-sighted nor colour-blind he will be promoted to engine cleaner.

Cleaning the Iron Horse.

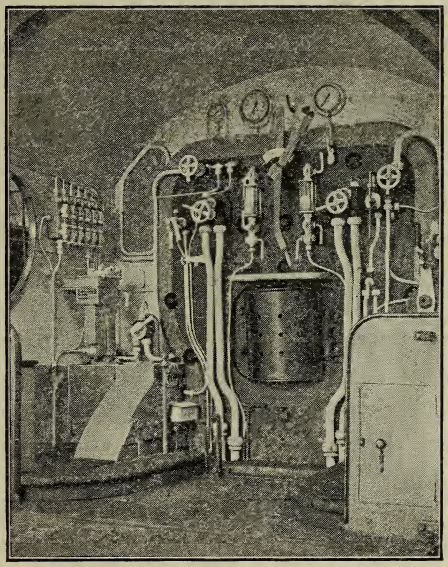
He now begins to learn something more of the different parts of the engine. There are usually four youths set to clean a locomotive, and the cleaner does not specialize on one particular portion of the engine, but with each successive job cleans a different portion. He will probably commence with the left side wheels, secondly the right side, thirdly the motion work underneath the engine, and lastly the footplate and the boiler barrel.

A good foreman cleaner will point out to him how important it is for the credit of the railway company and his Station that the engine stock should always be bright and clean when turning out, and also how much better for the locomotive that it should be clear of grease and dirt, for, unless all the working parts are kept clear of grit and dirt, the locomotive cannot run smoothly. The enthusiastic cleaner will find much of interest in his duties which he will store up for future use.

A Trial on the Engine.

When he is considered proficient, further successful examination in various rules and regulations will bring him promotion as spare fireman, and as soon as possible he is put to work on an engine. How proud he is when the Superintendent calls upon him for a footplate job. The first experience probably will be on a shunting engine

in a railway yard, or with a slow goods train. This enables him to find his "footplate legs," and learn to swing the shovel, full of coal, whilst the engine is moving, without losing his balance, and put the coal in the right place—in the firebox and



Inside the Cab of the Engine.

not on the floor of the footplate, which is not quite so easy a task as may appear.

The name "fireman" at once suggests that his duties are to feed the fire. True, but he has more responsibility than this: the fire must be kept clean, so that there is always a good draught through the firebars to keep a good red glow and

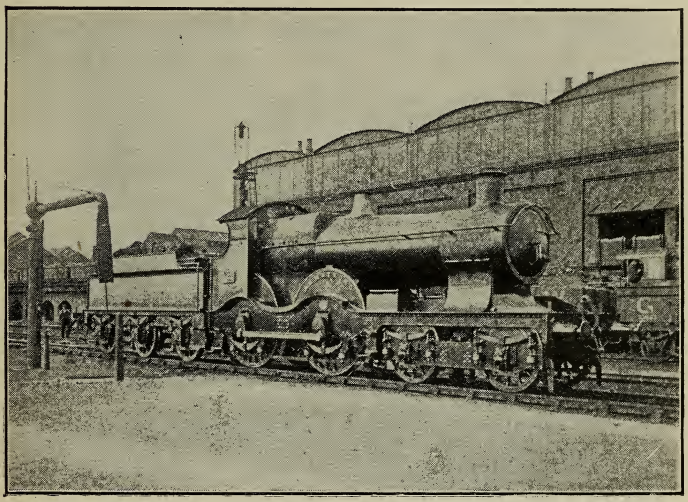
there must be a regular flow of water from the tender or tank to give plenty of steam, whilst he must see to it that the engine does not lack a liberal supply of oil. The footplate he must keep clean and tidy. He is also out to learn, and his best method is to watch his driver carefully, when his own duties permit, for it is difficult to explain in mere words how to drive an engine, and there are very few drivers, and they are ready to admit it, who can explain: experience has taught them, and it is a good school.

The fireman obeys without question the instructions he receives from his mate, and he must never forget that only one man can take charge, i.e. the responsible driver. As time goes on the young fireman learns more and more; when he has been taught to read the signals, to know the various junctions, curves and grades on the road, and how to handle an engine, he is appointed a "passed" and not a "spare" fireman. After passing further examinations he is eventually appointed "driver." Gradually working up and keeping a good record his ambitions ultimately lead him to the footplate of an express passenger engine.

With the Driver on an Express Passenger Train.

The enginemen whose names appear upon the engine shed list to work express passenger trains are the best of their kind: a glance in the books

at their records since joining the railway service shows they have few, if any, black marks against their names, never over-running platforms, or failing to stop at signals, which by their sign command them to stop. The cabs of their engines are a credit to them, and the trains they work

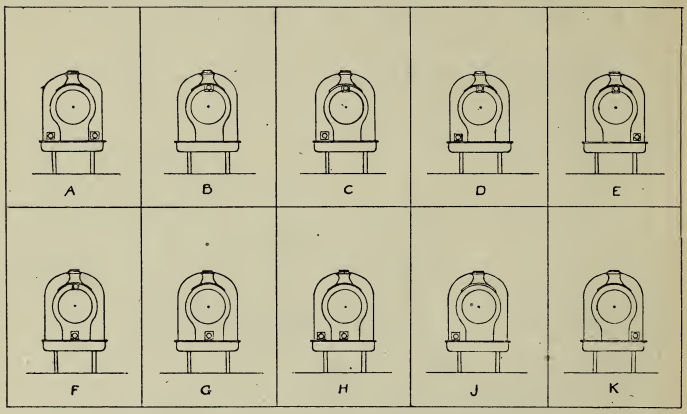


Taking the Engine for Water.

are seldom late from causes for which the engine staff is to blame, whilst they always succeed in getting the best out of their engines, by not punishing them, but by handling them with care on up and down grades. They are men who love their work.

Now take a journey on one of these express engines. The driver and fireman arrive at the

shed some little time before the engine is booked to leave, and make their way to the office to sign "on duty." If the driver is at all uncertain he enquires the stations at which the train is booked to stop, and whether there are any places



A Complete Set of Engine Headlights.

A. Express or Accident Train.
B. Slow Passenger or Breakdown Train returning.
C. Express Food Train or important Horse or Cattle Train. Most important Goods and Mineral Trains.
D. Train of Empty Coaches.
E. Second Class Food, Goods or Cattle Train.
F. Express Cattle or Goods Train. Third Class.
G. Engine; Engines or Engine and Guard's Brake Van.
H. Goods or Mineral Train. Fourth Class.
J. Goods or Mineral Train stopping at several stations.
K. Slowest Goods or Mineral Train, stopping at nearly all stations, commonly called "The Pick-up."

on the journey at which it may be necessary for the train to slow down on account of alterations to the line being carried out. He is careful to assure himself that there is a plentiful supply of oil sufficient to last throughout the trip. Then comes his most important duty, the examination

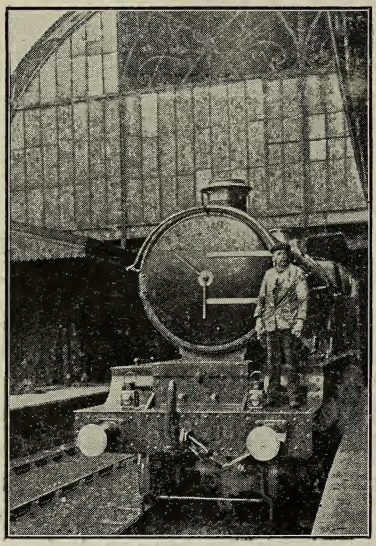
of the locomotive, which will shortly be speeding along at a great rate: he walks slowly round, carefully overhauling the different parts, examining the oil cups, goes underneath with a spanner to test the different nuts to make sure they are tightly screwed, for the loss of one of these may cause considerable trouble, and at last is satisfied that, so far as he can judge, everything is in perfect running order.

The fireman meanwhile reports that there is a sufficient supply of water in the tender, coal on top, all the necessary tools, shovel and fire-irons, also lamps, fog signals, oil cans, cloths or waste in their places, and that the lamps are trimmed. One of these lamps is placed on the front of the engine over the centre of the buffer plank (see G), and a red light at the back. There is a code for the position of these engine headlights or lamps with the meaning of which railwaymen working in the operating section of the railway are familiar. The placing of this lamp over the centre of the buffer indicates the engine is to run "light," that is to say without any train attached in the rear, but this will be altered when the engine is hooked to the train at the station. Everything is ready for the start.

The "Right Away."

The driver stands at the right-hand side of the cab, which on most locomotives is the correct

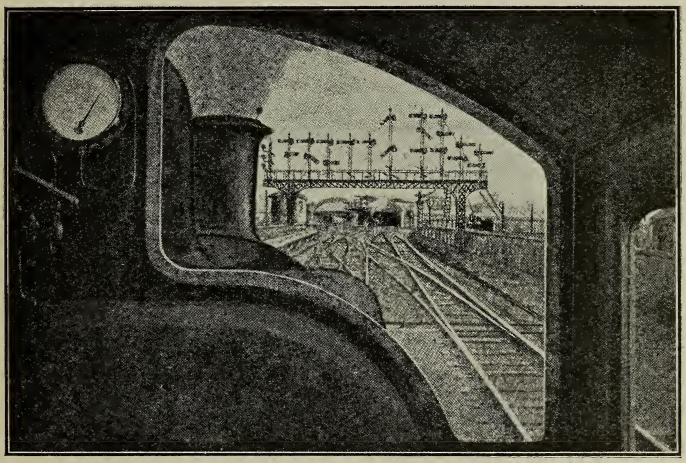
position, (on some engines the arrangement on the footplate is different,) whilst the fireman is on the left. The signalman in the box at the entrance to the yard is looking out at the engine, and the shunter is consulting his watch. "Are you ready, driver?" he asks. The driver nods, and tugging at the whistle chain a short crow warns the signalman that the driver is anxious to be moving forward. If the line is clear down goes the signal, and the engine moves slowly towards the main line, followed by a cheery "Good luck, driver," from the shunter, and quietly runs forward into the terminal station which is the starting point for the express train.



Express Headlights and a Last Look Round.

The engine is coupled up to the train almost without any of the seated passengers knowing that this is being done, and the fireman now places his second lamp over the right-hand buffer in front, moves the one from the centre to the left-hand side and takes the red light from the rear.

The engine is now carrying what is termed "express headlights." A few of the curious, who are desirous of knowing the class of engine in front and the appearance of the driver in charge, stroll up, and cannot but admire the great engine with its high boiler, stumpy chimney and big driving wheels, all suggesting power and efficiency, whilst



As seen through the Cab Spectacles.

everything is so bright and clean. But a warning whistle from the guard sends the admiring sight-seers quickly back to their seats. Another whistle, followed by "Right, mate," from the fireman, who has observed the waving of the guard's green flag, and with a glance at the signal, the driver pushes over the regulator handle, which

releases the steam for its work, and the real journey has begun.

The conditions are not very good, as a biting east wind is driving small particles of snow against the cab windows or spectacles. This increases the difficulties of the "look-out," and as the train begins to gather speed the driver and fireman are forced to peer round the side of the cab to look for the signals and watch for obstructions on the line. After running for a few miles along a level stretch the land begins to rise, and in a very short time towering rocks and crags are to be seen on the one side, and deep sloping embankments on the other, reaching down to the edge of a stream. The engine glides gracefully round curves, but the fireman's shovel is now seldom out of his hands, as, coaxed on by the driver, the engine is straining her utmost to keep to schedule time up the steep hills. There is a great art in firing, and this man knows his work. A little at one time and often is his maxim, and this gives him the best results.

In the Tunnel.

A shrill whistle, and the train thunders through a small wayside station, then with a roar enters a tunnel. The cab quickly fills with smoke, and to those unaccustomed to riding on engines through long tunnels the sensation is anything but pleasant, although it is an experience. The fireman opens the door of the firebox, and the glare casts some uncanny shadows around, but it is

a big relief, as the draught now draws a considerable amount of the smoke into the fire. The loud clanging of the warning gong sets the driver and fireman peering intently ahead, and suddenly a green light flashes up and is gone: the train is signalled "right ahead." The train is now racing on a down grade. A peculiar buzzing fills the ears, and without any warning the engine bursts into the open air once again. In coming round a curve a red light, well in front, shows up, and the passenger on the engine listens to hear the brakes grind hard on the wheels, but the driver makes no move, and one wonders if he can have missed that challenging danger light. The train, however, rushes on, and passes the danger signal well on the left in a siding; it is not intended for the express. The curve is deceiving, but the driver knows his road.

The train is now making good progress, but suddenly there is real danger ahead. The driver shuts off the steam, and puts on his brake. He calls to the fireman, who applies sand to the rails through the sand-pipe, which assists in increasing the pressure on the wheels, and brings the train to a stand. Many windows in the train are lowered as the fireman springs from the footplate on to the line, and commences to drive off cattle which have strayed through broken fences to the railway. When the danger to the train and cattle is removed a fresh start is made, and soon a high speed once more is attained.

Picking up Water.

Spurts of water splashing from underneath the tender prove that the train is passing over a water trough, and that water is being forced into the tender. These troughs are a great saving in time, and enable 2000 gallons to be picked up in

65 miles an hour and Picking up Water.

a few seconds whilst running at a high speed. They are usually about 500 yards in length, 18 inches wide, and 6 inches deep, and are laid in level stretches of the line. The scoop, 10 inches wide, which picks up the water, is lowered by

the driver and dips about 2 inches below the surface of the water. The speed of the train gives the force necessary to lift the water into the tank. The noise of the splashing water ceases, and the train is past the troughs.

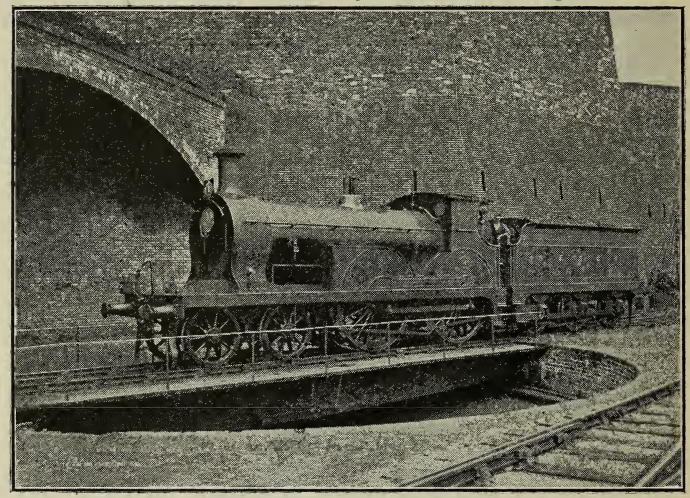
It is rapidly growing dark, and dimly a long goods train is observed slowly travelling towards the express on the opposite road. The driver discovers his journey is not to be completed without further incident. Smoke is issuing from one of the wagons forming the goods train, and little darts of flame prove that the contents are on fire. Reaching overhead the driver of the express pulls a chain, and the steam whistle continues to send out sharp warning pops until the attention of the other driver is obtained. The brake is once more applied, and both trains come to a stand. The express engine is fitted with a fire-hose, and this is brought into use. Very rapidly the flames are subdued, and the express again resumes its eventful journey. These incidents are by no means uncommon on the railway, but it seldom happens that an express train has two such exceptional stops in a single journey.

At the End of the Journey.

The enginemen are not further interrupted and no more time is lost, and although the train ultimately glides into its destination station a little behind the booked time, the run has been

a good one, except for the compulsory stops not shown in the time-table.

The engine, now black and greasy, is driven to the running shed near by, where the driver and fireman berth it in one of the shed roads, give a little necessary attention to the machine,



Turning the Engine Round on the Table.

and then, locking up the tool-box, take the keys to the office. A ticket has to be made out showing the times of running and the minutes lost on the journey after which all that remains to be done is to sign the book "off duty" and turn into the Company's dormitories or barracks. Old schools and houses near the Engine Shed are sometimes

bought and transformed into dormitories, and are arranged with reading-room, bath-room, and small cubicles each containing a bed. After making themselves clean the men probably have a read, and in a short time turn in to get their rest ready for the next trip towards home.

The Driver's Knowledge of the Road.

The reliable driver has four maxims which he ever keeps in mind :—

1. To observe accurately.
2. Think carefully.
3. Decide rightly.
4. Act promptly.

When he is out with the engine he is very observant, taking notice of all the points along the road, such as bridges, ditches, streams, rivers, works, but particularly the different signals. He learns every curve, knows exactly where are the boards restricting the speeds, can explain the position of the mile-posts and gradient-posts, and what is more, as the train travels along, he knows the various destinations of most of the trains which are passed by.

In the darkness as the engine rumbles with its train over a viaduct by the very sound he knows exactly the spot, and can see in imagination the white road or the ribbon of water below. Passing through a cutting, still in the darkness, he finds it easy to calculate when the rocky or

grassy sides which shut him in will give place to open country once again. Yes, the driver must know well the road over which he has to travel, and every six months signs what is called the "Road" book, to indicate that he is quite familiar with the railway districts through which he may be required from time to time to work trains. If he is uncertain of any portion of the road over which trains from his depot are worked he must not sign that he has a good knowledge of it, and he will not then be called upon to take charge of a train job over that portion of the railway.

Driving in "The Old Days."

This is a big change from the old days when a perfect acquaintance with the line was not considered so essential, as the following little incident illustrates. About forty years ago the Locomotive Superintendent of one of the principal railways was out with his inspection carriage visiting several of the running sheds under his charge. He decided to go further than he had at first intended, but wishing to know if the old driver was familiar with the road to the next locomotive station, asked him if he was able to take the train so far. The answer was unexpected.

"Master, is rails laid ?"

"Certainly," said the Superintendent.

"Then get in, sir ; I'll find it."

The old express drivers cannot always carry

on. There comes at last a day when they are unable to stand the hustle and strain of long distance fliers, and regretfully they give way to the younger men who are anxious to win their spurs. They spend a few years with slow passenger or slow goods trains, dropping gradually to the humble shunting engine and eventually retire from active service to enjoy a well-earned rest.

Many old drivers still hear the call of the railway, and on fine days can be seen leaning eagerly over the parapets of railway bridges watching the great expresses which they used to drive rushing swiftly by.

CHAPTER IX.

JOURNEYING BY PASSENGER TRAIN.

In the first days of railways travelling was almost solely the diversion of the rich, as only the leisured classes could afford to make long journeys to far-distant towns and seaside resorts, but Mr. Thomas Cook in 1840, on behalf of a temperance league, went to interview the representative of one of the large railways and pointed out that a numerous party desired to travel together in the following week. Could not a special train be provided, he asked, and tickets issued at specially low fares ?

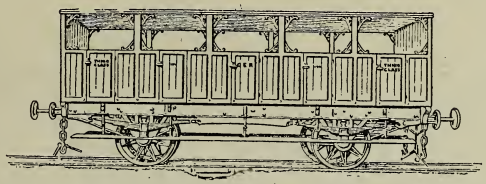
The idea was quite new, as it was foreign to the practice of the railway companies to depart from their ordinary time-tables and run special trains for picnic parties, or Associations, and to offer cheap fares was thought an extraordinary thing. But it was carried out, and thus commenced excursion traffic.

Early Railway Travellers.

The passenger trains were not, however, composed of comfortable carriages but were formed mostly of coaches open at the top and without

windows, and when there were more passengers than the ordinary coaches would accommodate cattle trucks were attached to the trains and forms placed inside.

Those critical passengers who, at busy times, especially during the Bank Holiday seasons, are crowded into old third-class carriages which the railway companies have had to utilize, would be amazed if they could see the conditions under which the early excursionists formerly travelled



An Old Open Carriage used on the Former Passenger Trains.

to the country and the seaside. The coaches were by no means smooth in running, they had no well-cushioned seats, but hard boards and there were no windows. The travellers were compelled to sit with the wind blowing in their faces and dust blinding their eyes. If food was not taken in the compartment the passenger had to go hungry, unless he was able to obtain a hurried bite at one of the very few refreshment rooms at the larger stations.

At the end of the journey the passengers usually came out of the train like groups of colliers straight from the coal mines, blackened with

the smoke from the engine and dust from the railroad. At night oil lamps were lighted, but these were too dim to allow of comfortable reading, and passengers became accustomed to the necessity of carrying candles along with them which when lighted only made the air more

Until 1911 this Coach was drawn along the Railway by a Horse. ("Dandy"—Horse and Coach.)

oppressive. It was not until 1863 that gas lighting was introduced. The North London Company were the pioneers in introducing this convenience.

Added to the discomfort of jolts and bumps over a rough road in cold weather, the journey was made more miserable by the fact that there

was no heating apparatus; there were only a few footwarmers, and these were provided only for first-class passengers on long-distances express trains.

People did not then understand what high speeds could be attained by trains drawn by steam locomotives, and many were killed or injured through jumping out to recover their hats which had been blown off. Troubles often arose through passengers losing their tickets. These were not the handy pieces of cardboard in use to-day. Most of the companies issued long slips of paper, and the passenger had to wait while the booking clerk filled in all the particulars, which included the name and address and also the number of the seat in the train. On a railway near Leicester pieces of metal were used as tickets, but a man named Edmondson solved this difficulty by inventing a ticket machine which printed tickets somewhat similar to those at present in use.

When railways were established, first and second-class compartments only were introduced, but later third-class passengers were carried on goods trains. The companies did not like third-class passengers, as, by Act of Parliament, they were only allowed to charge 1*d.* per mile; and in order practically to compel people to travel by first or second classes, they used to allow people carrying fowls and pigs to journey in third-class compartments, and were even accused of sending many chimney-sweeps into the train with their bags of

soot to render third-class travellers uncomfortable. So slowly did these trains travel that it is sarcastically related how, on one occasion, a costermonger on the back of his donkey undertook to race the train and actually won.

There have been many changes since these old days, which are still often referred to as "the good old days." Travelling has been brought within the reach of all, and the fares are comparatively so moderate that few can excuse themselves from taking trips into the country for a change on the ground that the expense is too great.

At least one noteworthy feature belongs to the distant past. Eighty years ago four engines drew the longest train. Six thousand people filled sixty-seven coaches forming one train.

It was usual for holiday makers to set out for the station in cabs with all kinds of boxes and bags, rushing about the station with their luggage and begging the guard to look well after their belongings. All this trouble was avoided when the "luggage in advance" system was introduced. Merely to go to the station or the railway agent's shop in the town and fill in a form requesting the vanman to call for the luggage is sufficient, and the payment of a small sum saves a world of trouble and anxiety.

Modern Express Trains.

Starting from one of the large terminal stations upon a journey by a modern express the traveller

finds every comfort provided. Coaches sixty feet long and splendidly fitted invite him to enter. There are no draughts, the seats are perfect, hassocks are sometimes provided for the feet and rests for the arms. There is a handle by means of which the passengers can themselves control the steam heating arrangement, and a bell push to

Express travelling at high speed.

summon an attendant from the kitchen to supply either a sumptuous dinner or a drink of tea.[1]

A communication chain overhead gives a feeling of security for emergencies or danger; the pulling of this chain will quickly apply the

[1] The Great Northern Railway Company in 1879 were the first to introduce Dining Cars on railway trains.

brake and bring the train to a dead stop. This is an invention of recent years. The railway travellers of bygone days had to depend upon the power of their lungs or make signs of distress, to attract attention, although at a later date a rope outside the coach when tugged would set a bell ringing loudly and long in the guard's van. The guard would then attract the attention of the driver by setting a large bell ringing on the side of the engine tender. The old order of things has changed.

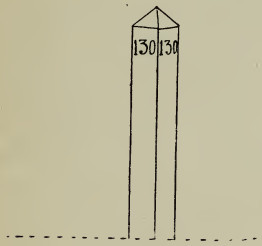
In another direction the protection of the passenger has not been overlooked. The corridor of the train[1] is not without interest. Chemical extinguishers in easy positions are available in case of fire, and through the door communicating with the guard's brake can be seen a small collection of tools—an axe and saw—which are there for immediate use in the unfortunate event of an accident.

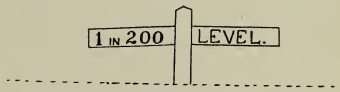
Through the same open doorway the interested passenger may have the good fortune to see a coach "slipped." Fast expresses do not even stop at important stations, and what is called "slipping" a coach whilst travelling at a high rate is carried out on a number of through trains. There is a guard in each of the two coaches, and after making signs to one another the guard in the main part of the train

[1] Corridor carriages were introduced into England by the Great Western Company in 1892.

pulls a rope which releases the coupling connecting the carriages, and soon the rear vehicle is seen to be quickly dropping behind as the guard therein applies his brake. The train guard waves a green flag to his driver, steam is applied, and a high speed is once more attained, the "slipped" coach meanwhile being brought to a standstill beside the station platform.

On the left-hand side of the line small posts are to be seen with "8," "$\frac{1}{4}$," "$\frac{1}{2}$," "$\frac{3}{4}$," and "9," "130," or "200," etc., painted on. These figures indicate the miles travelled from a particular station. Whilst the train is travelling at a high speed





passengers can, by means of these posts and a watch, calculate the speed of the train. There are 3,600 seconds in an hour, therefore, travelling at one mile per hour, it would occupy 900 seconds to travel between two of these quarter-mile posts. Travelling at 60 miles per hour would take only 15 seconds to cover the quarter mile, and if 18 seconds elapsed the speed would be 50 miles per hour. Any speed can be worked out from this simple table.

On the opposite side (the right-hand) of the

line are small posts (see p. 145). These show the rise and fall in the track, and the board slanting downward showing 1 in 200 means that the fall in the road is 1 mile in 200 miles or 1 yard in 200 yards. Where the road is quite level this also is shown.

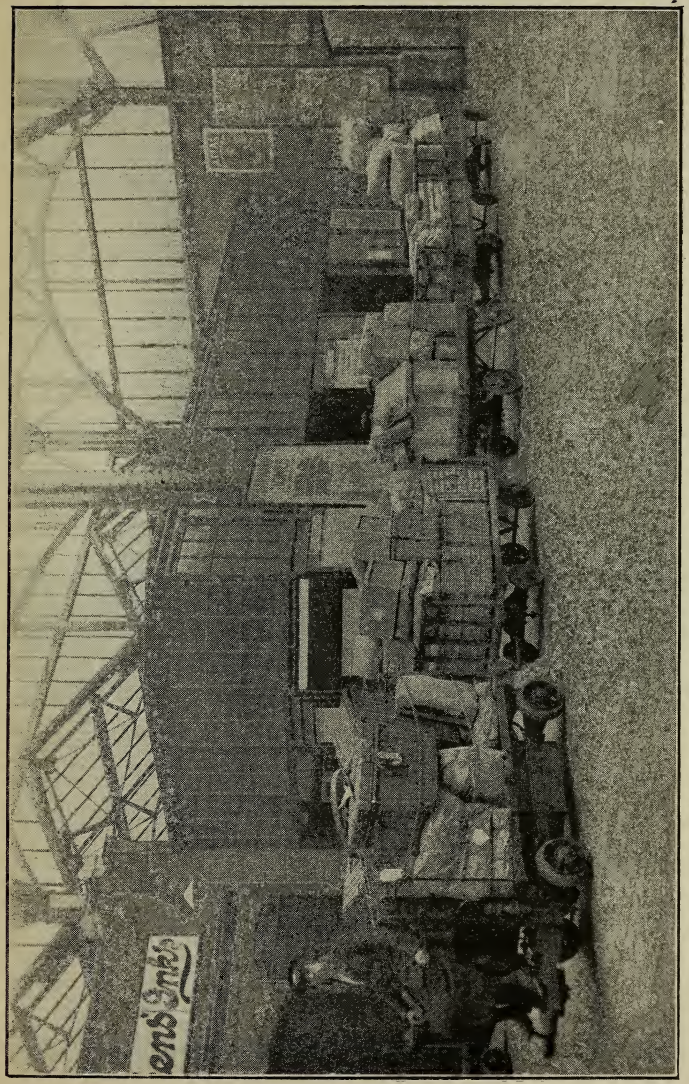
A Junction Station.

Stopping for a few moments at an important junction station, there is a scene of considerable bustle, loading up of boxes, parcels and bicycles, and the movements of passengers who are changing trains. On the platform may be seen a recent invention, the electrically-propelled travelling truck, and at a busy station which deals with a very large parcels traffic there is quite a train of trucks rapidly moving along the platform. These greatly facilitate the handling of station traffic.

Hydraulic or electric hoists are seen lifting heavy boxes to a gangway over which they are passed to another hoist and so to other platforms.

Meanwhile the driver of the train has taken advantage of the few minutes' wait to take the engine to the parachute water column and fill the tender with water ready for another race through the country.

Continuing the journey, hamlets, villages and small towns, junctions large and small are passed,



Platform Electric Truck with Train of Trucks.

whilst woods, plantations and fields are rapidly left behind. Rivers, streams, canals and roads are crossed, bridges and viaducts passed over, while high embankments, long tunnels and deep cuttings form part of the interesting panorama. English scenery is good to look upon—there is no need to be weary on a railway journey.

Travelling forward the express passes an

Five-Car Electric Train L. & Y. Railway.

electric train on an adjacent line: it is a suburban passenger train. Electric trains are excellent for suburban traffic, being much cleaner than steam trains and having the advantage that they are able to start away rapidly from stations and they can be brought to a standstill from a high speed much more quickly. More will be heard of electricity in its relation to transport.

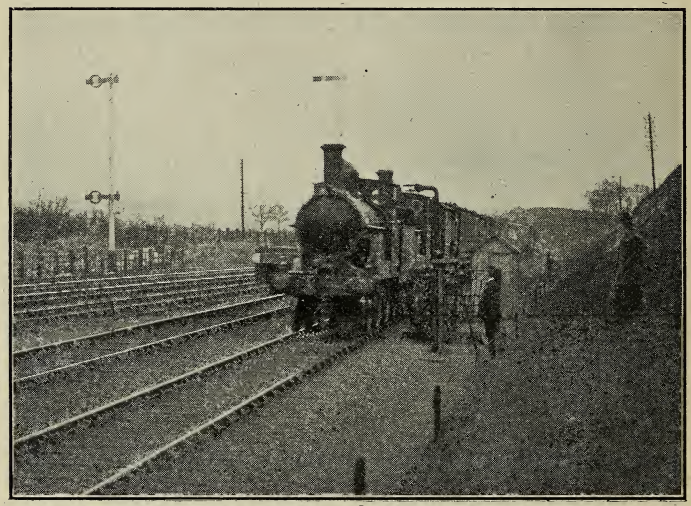
Gathering and Dropping the Mails.

In the night a fast train roars past on the opposite road, and a fellow-passenger volunteers the information that it is the north-bound mail train. This is an interesting train. In the old coach days the mail was carried by road between London and Edinburgh at an average speed of seven miles per hour. The Scotch mail train running out of London, known as the "West Coast Postal," is the most famous mail train in the world. Before the train is ready to depart the Post Office vans roll up to the London station in what seems to be a never-ending stream, and at the last moment arrives the mail van with the express letters, and the train is soon steaming northwards, upon a journey of 540 miles, to Aberdeen.

The first mails, conveyed by rail, and made up in bags, were taken by the guard of the train who travelled outside the coach. As the train approached a station the guard would throw out the bag. Very often these bags were run over and cut to pieces. The present system, invented in 1838, is a great improvement.

There is a regular army of sorters in these travelling post offices, who, with shirt sleeves turned back to the elbow, are kept hard at work sorting out the letters into pigeon-holes for the different places on the route. An expert at

the work will sort from 40 to 50 letters per minute. The bags are made up ready for the various towns, and as the train approaches a point at which one of these is to be left the bag is hung on to an arm which is slung outwards, and the nets are spread out at the side whilst



About to Pick up the Mails.

the coach doors are rolled back, for the train is to pick up as well as drop a mail.

Along the line a postman is sitting quietly in a small hut by the line side. He has hung his pouch of letters on a post and is waiting the arrival of the train. The "Mail" rushes up and strong ropes, placed in a suitable position

at the side of the coach, knock off the pouch into the nets and into the van. The bag, suspended from the arms on the train, is also knocked off, and this the postman picks up and takes to the local office where the letters are sorted for the morning delivery.

The train stops at some of the most important stations, and again takes in and leaves off large bags of letters. These large stations are collecting points for mails sent from all parts of the country, and the work of sorting, picking up and setting down goes on throughout the journey. Next morning thousands of postmen in cities, towns and villages are delivering letters which have travelled long distances by the "express post offices." The recipients of these letters little dream of the adventures through which their correspondence has passed on its long night journey in the "Mail."

CHAPTER X.

FROM COLLECTION TO DELIVERY BY ROAD AND RAIL.

THERE is a great deal which is mysterious to those outside the railway, about Goods trains, commonly spoken of as "luggage" trains. They know very little more than what they can learn from a passing glance as these trains travel along the lines. "A peep behind the scenes" before and after those trains pass before the public view on the railway lines is full of interest.

The first and naturally the most important business of the railway companies is to obtain goods to carry. They, like other successful business firms, do not believe that "all comes to those who wait," but rather in the command to "seek and ye shall find." They, therefore, employ a staff of men whose special business is to induce large and small firms to send bales, packages, boxes, machinery, boilers, guns, etc., by their own particular railway. Such a man is known as a Canvasser or Agent.

Agents and canvassers are established in all the principal towns and cities, and where there is more than one railway running through a particular

area the rivalry between the canvassers of the different companies is naturally keen.

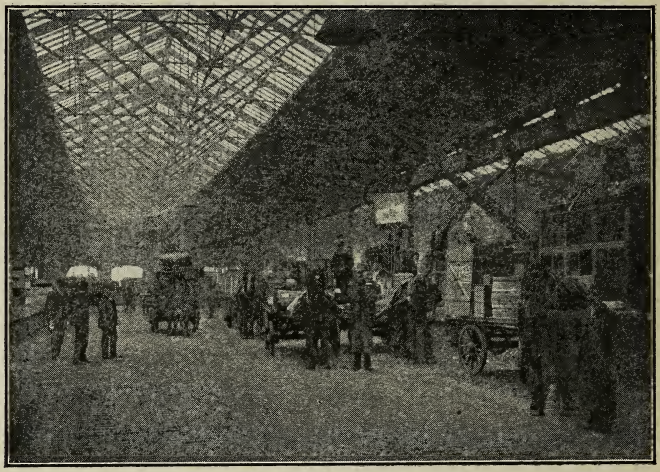
Collecting the Goods.

When the town canvasser or agent has obtained the promise of a firm to send certain goods by his railway the railway carter is instructed to call with his lorry, or dray. Railway cartage is now a big business, in striking contrast from the conditions prevailing when all styles of vehicles, owned by all and sundry, brought in the goods at their own convenience. In Britain the railway companies do their own collecting and delivering, but on the Continent and in America it is practically all performed by private carriers. The carter duly arrives on his round and, standing at the foot of the warehouse stairs, will call out loudly the name of his railway. The warehousemen haul out the load, and the office boy brings the note which contains particulars of the goods being sent, name and address, weight, etc., and, in his own youthful style, asks the carter to sign the firm's book. This the latter will do if the goods are all right, so far as he can tell, and properly packed.

Arrival at the Goods Shed.

And so the carter drives from place to place, loading up his lorry, and late in the afternoon he can be seen turning his horse and dray into a large

Goods Yard, and drawing up to the side of the shed platform. Other drays have arrived from various parts of the town, and more continue to come in, motor as well as horse lorries lining up along the cartroad by the platform. The goods



Lorries arriving in the Shed with the Load.

are removed from the drays and carefully examined to see that they agree in number and description with the entries on the notes brought in by the carters, and are undamaged. Each lot is then passed to the scales and the weight is marked on the note.

Transferring to the Railway Trucks.

The goods porters, usually called "truckers," are directed to which wagon the various lots are

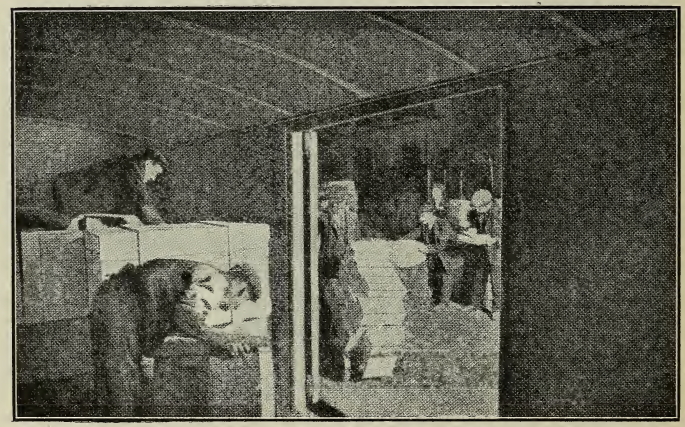
to be taken, or, if the wagons into which they are to be placed have not yet been brought into the shed, are placed in groups to be loaded up when their turn arrives. The porter simply conveys the goods on a truck from the scales and

Ready for the Night Trains. Loads on the Stage at Noon.

places them on the floor of the stage near the wagon. It is now the turn of the loader.

It is a mistake to suppose that any one without experience can properly load a wagon, provided he is strong enough to do the lifting. Loading is an art acquired by long practice, and foremen and agents in charge of goods depots are careful to see that the men engaged in this particular

work are fully qualified. Before any goods are placed inside the wagons are examined to make sure they have been properly cleaned out, for if they are wet, or any large nails are showing their points inside there is every likelihood of the goods becoming damaged. The heaviest articles are first placed at the bottom, as it would be folly to load a sewing machine on top of a thin wooden



Goods are carefully Packed in Covered Vans.

box containing eggs, or heavy chairs resting on soft cheeses. The loader finds out by experience the best methods of loading, thus reducing the possibility of damage, and utilizing all the space in the wagon so that there is no waste room. A plentiful supply of straw helps to secure the goods and prevents them from rubbing one against the

other when the train is in motion or during shunting work.

Different kinds of wagons are used for various classes of traffic. Covered goods or box wagons, similar in build to a furniture van, but having side instead of end doors, are used for goods which are most likely to be harmed by exposure in bad weather, whilst wagons open at the top are used for other classes of traffic. If traffic in these latter wagons must be protected it is covered by a strong tarpaulin sheet, secured by ropes to hooks and rings at the sides of the wagon. Articles in these wagons are so loaded as to form a pyramid in order that rain will easily run off, or an iron rail is fixed above the centre of the wagon, and the sheet is thrown over, which, falling to the sides of the wagon, forms a natural pyramid.

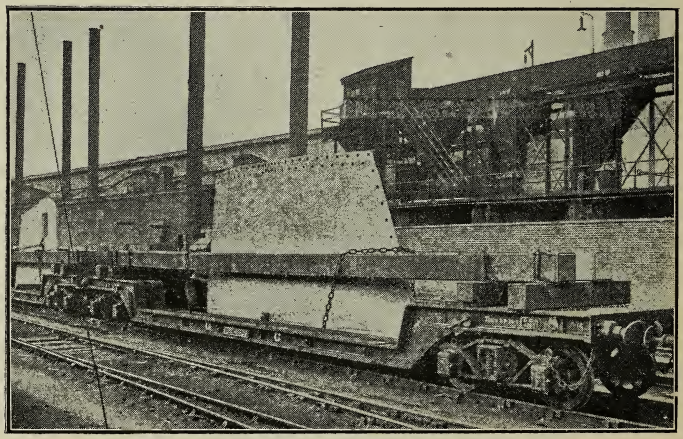
In each case the number of the wagon is marked on the note. These notes are taken into the forwarding office, where the clerks work rapidly copying out the particulars on to other notes called invoices, to go forward with the train, which must not be delayed.

Hundreds of these bills are made out at a large Goods Station each evening. The goods are described, the address entered and the weight shown, and, what is most important, the charges for conveyance calculated. There are thousands of rates for various classes of goods, and the men by long practice commit many of them to

memory. When the charges are worked out, notes are taken and placed under a clip or in a small metal box on the wagon side.

Heavy Loads.

Outside in the yard a very heavy iron casting is being loaded by means of the overhead travelling crane on to a special wagon capable of hauling

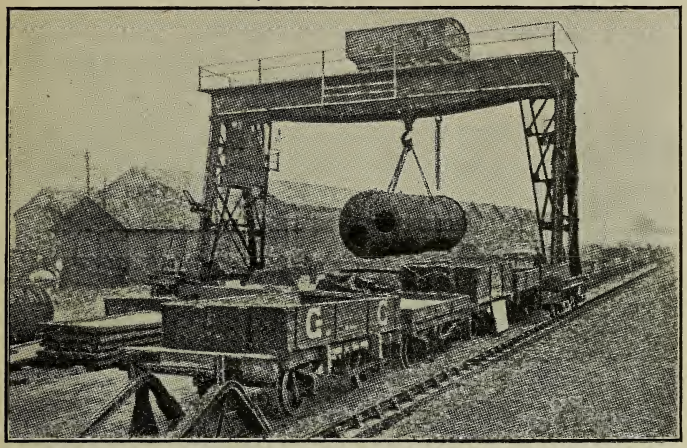


A Heavy Plate loaded on a Well Truck.

very heavy weights. This wagon is called a "well-truck," deriving its name from the pit or well in the centre.

A huge boiler is also being loaded by the crane into a boiler wagon. These boilers are at times loaded at the maker's works, especially when

there is a siding from the company's line direct into the works.



Loading a Boiler with the Overhead Steam Crane.

Departure of the Fast Goods Train.

At last the whole train is complete, the engine is "backed on," and the goods guard comes along armed with his basket of food, his red and green flags and his lamp. He has a word with the inspector on duty, counts the number of vehicles forming his train, makes a record on his printed statement, and as soon as he knows everything is right gives the driver the signal to depart and steps into his brake van.

The train is a heavy one, having no less than 40 loaded wagons, and is drawn by one of the

latest locomotives, of a specially heavy type designed to haul long trains at a good speed and to climb gradients. A passenger express passes the goods station as the slower moving train steams under the loading gauge[1] and approaches the top

The Heavy Goods Train waiting in the Loop for the Express to pass.

end of the yard. The latter is able to make good progress on the main road by following in

[1] The loading gauge is an upright post and a cross-piece. From the latter is suspended a semi-circular iron rod over the rails, This rod is placed at a height corresponding to the height of the inside bridge and tunnel walls. If any of the loaded wagons will not pass clear under the loading gauge they have to be reloaded, as otherwise they would not pass under the bridges or through the tunnels.

the wake of the express as soon as it is well clear and the signals have been lowered.

After running steadily for about ten miles the Goods train is turned off the main line into a loop line, which runs alongside for about three miles. On reaching the far end of the loop a danger signal calls upon the driver to stop. A passenger train is observed approaching on the main line, travelling in the same direction, and, therefore, the less important train is compelled to stand by.

Soon after the red tail light of the passenger train has gone from view in the distance the signal arm drops from the horizontal, and the steady green light bids the driver try again. Unfortunately, however, the day has been dull and misty with a drizzling rain, resulting in the rails becoming very greasy, added to which the train has been brought to a stand on a steep incline, and the driver finds it easier to try than to succeed. Every time he opens the regulator and "gives the engine steam," the wheels revolve rapidly and simply skid on the metals without the train moving forward in the least.

The fireman opens the sand-pipe and drops plenty of sand on the rails, which enables the wheels to get a better grip. Slowly the train creeps forward, the engine gradually obtains the mastery of its heavy load, and shortly reaching more level country begins to roll off the miles at the steady rate of 30 per hour.

Assistance in the Rear.

The surrounding country is hilly, and in the course of the journey a stiff climb is reached which the driver knows even his excellent engine, with such a heavy load, cannot climb without assistance. The train is brought to a stand and a smaller engine, which is in waiting at this awkward point, is driven to the rear of the train and renders welcome help. The top of the hill is reached in safety, and the "Banking" engine slips away again to watch for other trains in distress. It is a far better system than shortening the train so that the one engine can manage alone throughout the trip.

The first stop for work is at what is called a "marshalling yard," having a big network of sidings, and here a few wagons are shunted off and others attached to the train. Soon the train is careering along once more, but unfortunately the mist has become denser, and it is increasingly difficult to distinguish signals until very close upon them and the driver is forced to travel very slowly. It is evident that fog has been in this locality for some little time, as already the fog-signalmen are out, and the engine driver, whilst still keeping a sharp look-out, listens for the explosions of the detonators on the rails, which guide him as to the position of the signals. The slow progress of the train cannot be avoided, as it

would be madness to rush along on a dark foggy night. Safety must ever be the first consideration.

Train Divided.

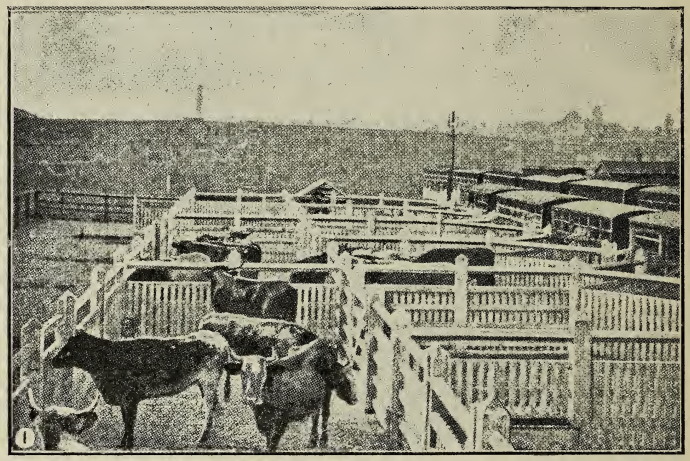
When starting away from a signal, at which the train has been held up, a sudden lurch forward warns the driver that something unusual has happened, and the vigorous blowing of the goods guard's whistle and the dull red gleam from his lamp decides him to stop. The guard comes along and informs the driver that the train is divided, owing to one of the couplings connecting two wagons having broken. There are two couplings, one at each end of a wagon, and by using the unbroken coupling the train is quickly coupled together again. The trainmen are glad they were not travelling any quicker at the time, or that they were not going up or down an incline, as there is danger with a divided train where the line is not level.

The fog having now become less dense progress is much more rapid, and a little later the train runs out of the bank of mist altogether.

Beyond Control.

In running down a steep incline the great weight of the train begins to force the pace, and suddenly the driver realizes that owing to the greasy state of the metals the train is beyond the power of his brakes and out of control.

The fireman once more sends out quantities of sand, and the guard, hearing the warning whistles from the engine, puts on his brake in the van, but without avail. The signalman, too, in his box, has heard the engine's appeal for help, and as the train passes his box pulls over a lever



The Cattle Dock.

in the cabin which alters the switch-points and turns the runaway into another road. A few seconds later the wheels of the engine and wagons are grinding deep in sand, and quickly the long, heavy train comes to a standstill. The appliance which has saved the train from disaster is simple, but very effective. Long iron troughs, in which rest the metals, and filled with sand and called

"sand drags," are placed at points on the railway where such difficulties are likely to arise. These have been the means of preventing many derailments and mishaps.

Although the special incidents related do happen it would be a very exceptional circumstance if all were to occur in a single trip, and the journey as depicted represents actually the difficulties encountered by several individual trains.

Arrival Next Morning.

Completing its night journey, after being released from the sand drags, the goods train in the early morning slowly draws past the cattle dock and into a large goods station, and in a short time the wagons are pushed forward into a shed, where the work of unloading immediately commences. Trains from other directions have been constantly arriving throughout the night, and owing to this particular train having been delayed, those trains carrying perishable foodstuffs, which are always unloaded first, have already been dealt with, and drays and vans containing barrels of butter, boxes of fish and meat are being driven out of the yard towards the big town markets.

The platforms again become the scene of bustle. The wagon doors are opened, sheets are thrown off, and soon the checker's voice can be heard above the general din, calling off from the invoices, which have now been taken from under the wagon-clips

or out of the metal boxes. The unloaders are lifting out furniture, crates of hats, boxes of jams, eggs, tobacco, sweets, toys, linens, cottons, and a miscellaneous collection of goods. These are grouped together by the truckers in lots on the stage, divided into various districts for delivery in the town, whilst jiggers, or chains and pulleys, as well as small cranes lift the heavier articles

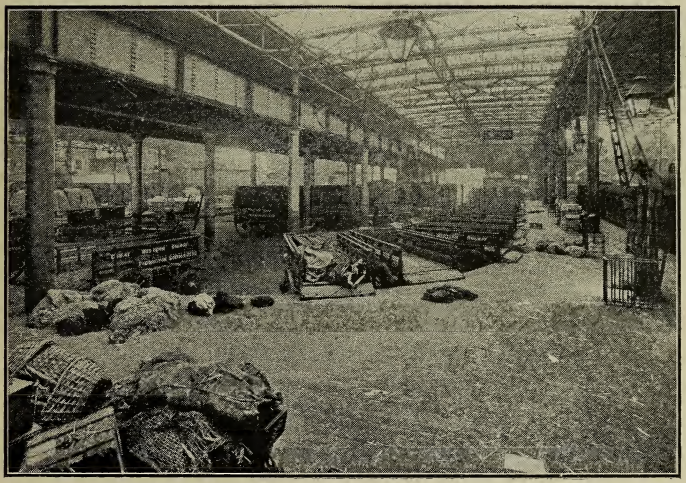
A Quiet Part of the Shed.

from the wagons. The carts back up and soon after, fully loaded, leave for the various shops and warehouses. Here is a wonder of transport, which other countries cannot equal on anything like the same scale, as in America trains generally travel longer distances and on the European Continent a great deal of the traffic travels by what are called *petite vitesse*—slow trains. In England goods collected late in the afternoon are

delivered in a warehouse 200 miles away the following morning.

Warehousing and Delivery.

Some of the contents of the wagons are not for immediate delivery, and the railway company takes them into its own warehouses



No Delivery on Sunday.

until sent for. Many firms have not sufficient space in their own buildings to store goods carried by rail, as, for instance, grain and potatoes, and so large warehouses have been built by the railway companies for this especial purpose. Many firms have no accommodation whatever but carry on the

whole of their business from the premises of the railway.

After the goods have been checked out of the wagons and loaded on the carts the invoices are taken into the Delivery Office. The sheets which the carter must take with him are made out, giving details of the goods and their destinations. The carter calls in for his sheets, which are signed by the various people to whom he hands over his packages, and thus the transit from sender to receiver is completed.

CHAPTER XI.

DISTRIBUTING THE COAL FROM THE COLLIERIES.

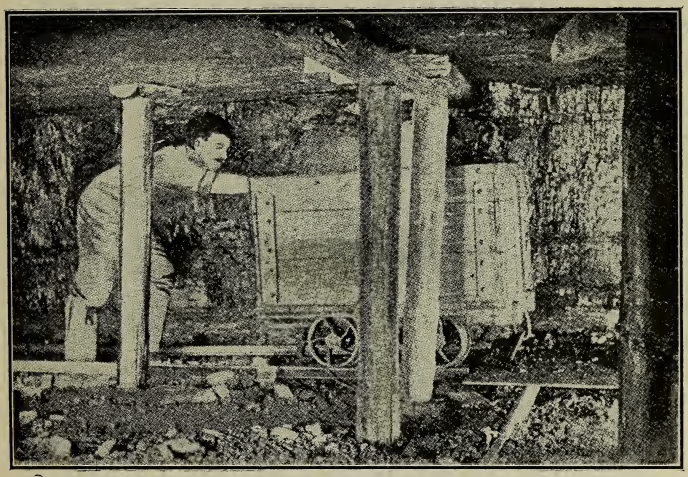
If England had a tropical climate and the population were principally occupied in looking after fields of cotton plants or the growing of fruits, tea, coffee, cocoa and grain, or if the British were altogether a nation of shopkeepers, as some foreign people are in the habit of asserting, Great Britain would be a very different place. But the island lies in a temperate zone, and small though it is, ranks amongst the richest in mineral wealth. Iron ore is found in abundance in South Wales, round about the river Tees in Durham, Cleveland, Westmorland, by the River Clyde, there is a vast bed in Lincolnshire, and also in that portion of the midland counties known as the "Black Country."

Coal is spread over a much wider area, viz: Lancashire, Yorkshire, Derbyshire, Warwickshire, Staffordshire, Gloucestershire, Nottinghamshire, North and South Wales, Durham, Cumberland, and the Central Lowlands of Scotland. Over a million men and boys are engaged in removing these "black diamonds" from the depths of the earth.

Industrial Map of Great Britain showing British Coal and Iron Fields.

At the Pithead.

When the coal reaches the surface of the pit a vital part of the work is accomplished, but much still remains to be done before it can be used for heating purposes. It is the task of transport to carry the coal to feed the furnaces at the mills



Transporting the Coal in the Pit.

and works ; to heat the water in the boilers of the locomotives ; to help to drive the mighty " liners " and puny " tramps " steaming across the ocean ; to " keep the home fires burning," and to assist other countries which have not sufficient coal for their own needs.

Some of the coal is taken from the pithead in

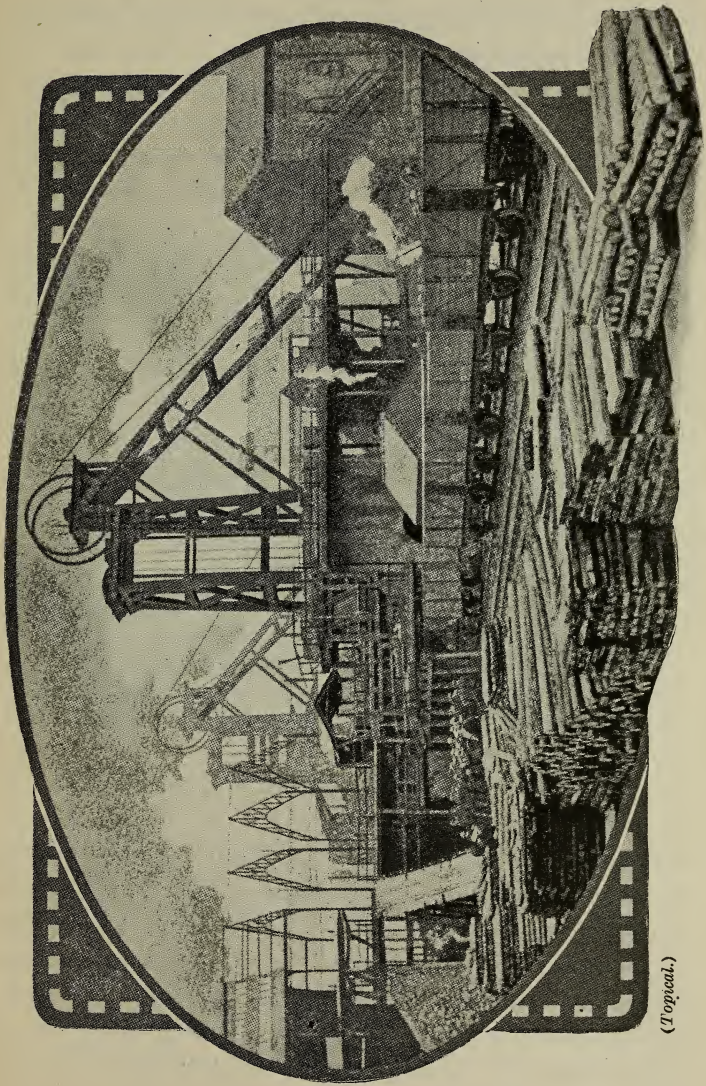
horse carts, the canal barges also are loaded with a portion, but it is "per rail" that the greatest quantity is conveyed.

It was the crying need for transporting coal which originally brought railways into existence, and to-day many of the successful railways owe their prosperity to the enormous tonnage of coal which they carry year by year. Altogether there are about three-quarters of a million wagons owned by railway companies, whilst private firms possess a similar number, and a very high proportion of these wagons are used practically for nothing else but the conveyance of coal.

Of late years specially large and powerful locomotives have been built for dealing with the coal traffic. These engines are capable of hauling long trains of 60, 70 and even 80 wagons in one train, carrying in a single journey at least 500 tons of coal.

The "Coal Age."

There are many who express the view that the use of coal will diminish as time goes on and eventually humanity will not depend upon it at all. Whether that view is the correct one or not, coal to-day remains the basis of the world's industries. This is the "coal age," and the richest nations are the greatest producers of coal. Of the 1,200,000,000 tons of coal extracted annually from the earth, nearly one-quarter comes out of the coal mines of Great Britain. Wherever



(*Topical.*)

Wagons at the Pit Head.

coal is found in abundance there or thereabouts do industries abound.

Apart from the coal which is consumed in the British Isles great quantities are exported abroad. It is despatched from the Bristol Channel, the North Eastern and North Western ports, the Humber, and the East and West Scottish seaports, principally to Italy, Sweden, Denmark, Egypt, the Argentine, Spain, the Netherlands and Norway.

To remove the coal from the pithead empty wagons are pushed down the colliery sidings to the screens and loaded for despatch. When the wagons are filled the giant engine backs up to its load and steams away, the long train of wagons following and winding round curves in snake-like fashion.

Controlling the Working of Trains.

An increase in the number of coal trains brought into existence what is called the "Train Control" or "Train Despatch" system. Owing to their weight and the slowness of progress compared with express passenger and goods these mineral trains were constantly being turned into refuge loops or shunted into sidings to allow clear runs for the faster trains behind. The length of time occupied on the journey in consequence led to the introduction of a system of controlling all trains from one central office, to

endeavour to move trains over the railroad with greater despatch.

The men selected for control work are experts in train working arrangements. The control offices are connected by telephone with every signal-box in the controlled area, and the men are able to

Helping the Trains along. The Train Despatch Office.

give advice throughout the day to the signalmen as to what they might do to avoid the various trains being detained in loops or sidings for long periods. A model of the line shows the control men where each train is located, and as the trains journey onward each signalman sends an advice of its progress, and the controller moves a clip,

representing the train, forward along the model railway. All trains are carefully watched in this manner right to their destinations, and thus long delays are largely avoided and traffic is worked through much more quickly.

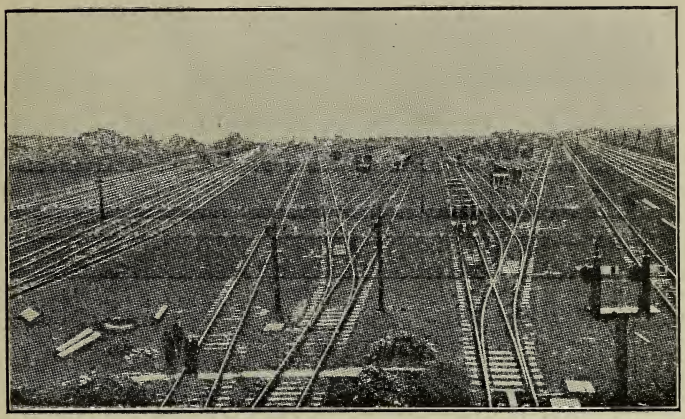
These Control Officers can also communicate with the locomotive running sheds and goods guards stations, and by knowing where all the trains are situated can readily arrange for tired drivers, firemen and guards, who have been a long time on duty, to be relieved by others who are fresh and ready for work.

Concentrating and Shunting.

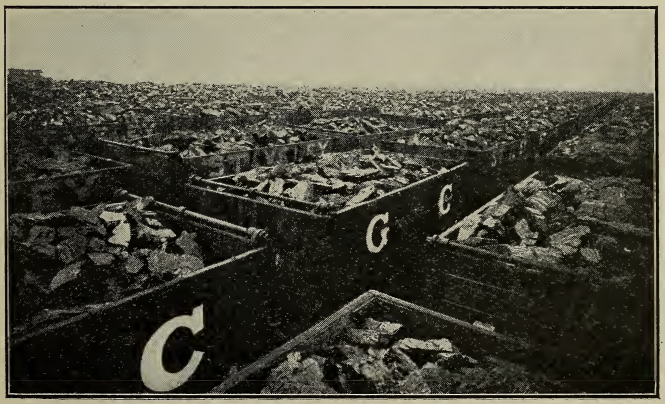
Much of the coal which is loaded into railway wagons at the collieries is intended for different directions, and so the trains from the collieries in a large colliery district make their way to what are known as "Concentration" sidings, where the trains are split up and the wagons sorted so that when the shuffling is finished all the wagons of coal forming a new train are for the one direction.

In the same way the empty wagons arriving at the yard on the return journey are sorted into complete trains for the various collieries.

In the course of the journey wagons are left off at the different stations in the short sidings specially provided. In some of these sidings are openings or shoots between the rails and the coal is dropped through into brick arches beneath.



A large Sorting Yard.



Miles of Loaded Coal Wagons ready for the Steamers.

Here the coal merchants bring the carts and load up for their own private coal yards. At other places the coal is shovelled from the wagons on to carts standing in a roadway alongside the line.

At the big works whole trains of coal are shunted into the yard and left for the owners to deal with in their own way. At the great seaports huge quantities of coal can be seen in long queues of wagons waiting to be tipped into the bunkers and holds of the giant liners and tramp steamers which carry on the enormous overseas trade. How it is transferred from wagon to ship is shown in a later chapter.

CHAPTER XII.

ACCIDENTS ON THE RAILWAY.

It is no national bias to say that British railways are as efficiently worked and as safe to travel upon as any in the whole world. Perfection, however, is something to strive after but very difficult of attainment, and on the railway, as elsewhere, mistakes are sometimes made which result in disaster.

When, however, there is taken into account the enormous number of trains which pass over busy sections of railway in a single day (hundreds of trains, for instance, pass in and out of Waverley Station, Edinburgh, every twenty-four hours), and the fact that trains are constantly approaching the same line at busy junctions from different directions, there is reason for congratulation that serious accidents occur so seldom. This is mainly due to the excellent organization and to the splendid mechanical contrivances invented, which render travelling by railroad a great deal safer even than crossing the main streets of busy cities. The natural calmness of the Britisher and his ready resource in emergency rightly claim a great deal of the credit in many instances. The average

number of passengers killed in a year on the British railways is only one passenger in $7\frac{1}{2}$ millions.

It is a very common saying that "a man who never made a mistake never made anything," and signalmen, shunters and drivers, who are ordinary human beings, are liable to commit errors which sometimes unfortunately result in mishaps involving the lives of passengers and damage to trains.

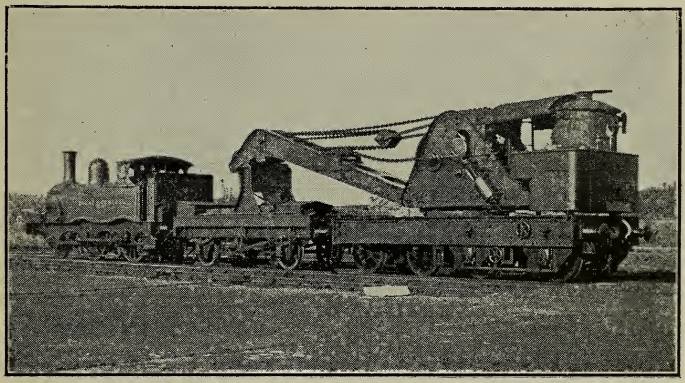
Out with the Breakdown Train.

"Accident"! This one word, spoken over the telephone to the locomotive shed, causes no little commotion. In the daytime the breakdown men are at work in the shops and shed, performing their ordinary duties, and are soon prepared for the scene of the accident.

If it is in the night the messengers and callers-up are soon speeding away from the depot to the homes of the members of the breakdown gang whose names and addresses are on a list posted in a prominent position in the shed office.

No time is lost in setting to work. The steam breakdown crane, one of which is to be found at all the larger locomotive stations, does not take long to prepare as the boiler fire is always kept burning so that steam can be quickly raised for working the crane for lifting purposes. The men, who have probably been disturbed from their rest, at the

call of the messengers hurry into the shed and take their places in their van which contains a number of hydraulic lifting "jacks" and other tools requisite for accident work. Should the mishap be serious and likely to occupy considerable time before the men will be able to return home food is placed in the van where a stove is installed,

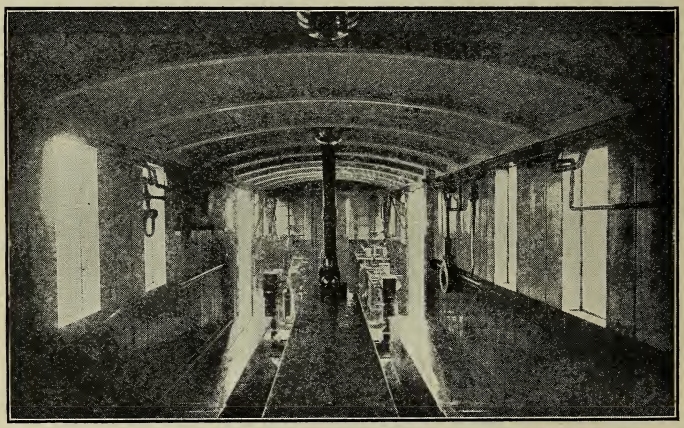


The Breakdown Engine and Crane preparing for Departure to Scene of an Accident.

which serves to heat the van and also any food requiring to be warmed.

When everything is in readiness an engine is attached to the steam crane and van, and no delay occurs in travelling to the scene of the mishap. If the line is blocked and traffic is held up at the point of the accident this train is allowed a "clear road" and all other trains must make way for the relief party.

Railway accidents vary in their gravity. A wagon may come off the rails owing, perhaps, to the junction points having frozen and so not opening or closing properly; or to a piece of stone from between the sleepers having wedged there, or it may be the wagon has broken down. These minor casualties are soon dealt with. It is, how-

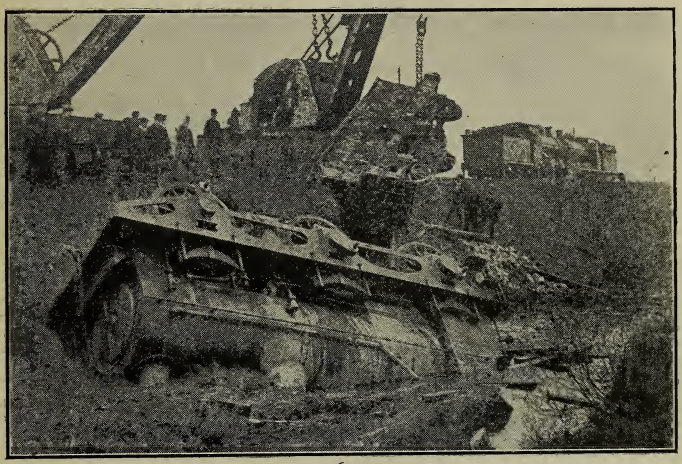


Inside the Breakdown Van.

ever, when collisions occur or an engine runs off the road with its train that the work of the breakdown gang becomes heavy and difficult.

An engine running off the road may fall down an embankment and lie on its side or even upside down, in the field or ditch. To pick up a large engine weighing, perhaps, a hundred tons is no easy task, and two powerful steam cranes may be

needed to restore safely the huge locomotive to its normal position on the railroad. This means



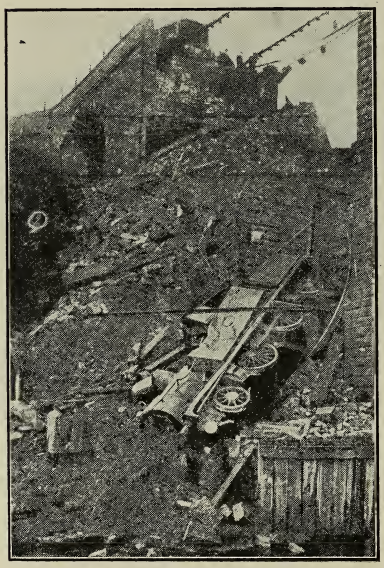
Thrown into a Ditch. Willing Helpers at Hand.

asking another depot to assist in the work of rescue.

Single Line Working.

Disasters to passenger trains may involve great labour ; carriages badly smashed leave a considerable quantity of wreckage to be cleared away, and may result in the railway in the district being closed for many hours until the obstruction has been removed. Probably only one of two main roads is affected, which means that for some time all trains travelling in either direction must be operated along the one line, and the usual signalling

arrangements have to be dispensed with. A pilotman travels on the engine with each train whilst platelayers with red and green flags and fog signals give the signals to approach, to pass along, or stop. The pilotman, perhaps a Station Master, wearing his red armlet, knows the section well, and is able to keep the traffic moving past the danger point. Just as the ship's pilot steers the vessel past sandbanks and shallows, so is the railway pilot able to indicate to the engine driver where he must drive with caution.



The Bridge gives way. A Nasty Fall for the Iron Horse.

There is no fear of trains travelling in opposite directions coming into collision, as no train can travel in the section where an accident has happened unless this pilotman is on the footplate, and as there is only one pilot, there can only be one train on the single line at one time.

Repairing the Road.

When the work of clearing the line is completed by the break-down gang, the platelayers set to work to put the road itself in order again. Rails have become twisted and perhaps broken, and there is much to be accomplished before trains can be allowed to use this particular line again. New rails and chairs probably are necessary and the ballast train brings them along. Meanwhile the labour of straightening and trimming the distorted steel line goes on without ceasing, until it is again safe for use.

Work of this kind is much more difficult in the darkness, especially in the winter time if fog adds to the gloom. Torches and bonfires have to be lighted to enable the relief parties to see at their work, as the feeble gleams from oil lamps are almost useless.

In long tunnels electric signalling apparatus is provided, by means of which the signalmen in the boxes at each end can be warned by trainmen of the occurrence in the event of an accident. In narrow tunnels there is very little room for manœuvring, and considerable skill is needed in dealing with derailments and collisions in these confined places.

After a big accident it sometimes takes several days to remove all traces of the occurrence. Following an accident to a passenger train about Christmas time, turkeys, hampers, plum puddings, toys, bags, boxes and furniture lay amongst

smashed woodwork and twisted iron and the wreckage in places lay piled several feet high. When the bigger obstructions had been dealt with thousands of splinters all had to be taken away.

No engines which have been off the road are allowed to travel on the railway lines until careful

Clearing up the Line after an Accident. The old Flagman is protecting the Workmen with a Red Flag.

examination proves them fit and safe for service. As the fires were raked out of the smoke-boxes before any attempt was made to lift them they are "out of action," and require to be hauled by other locomotives to their home stations, where they are for a time confined to the locomotive hospital for a thorough overhaul.

Rewards for Smartness.

The Royal Humane Society awards medals for great acts of bravery in saving life, and some of the railway companies follow this example and recognize meritorious conduct on the part of their servants in avoiding accidents, by presenting certificates and making money grants. The distributions of these awards take place each year, and many of the records form interesting narratives which do not always reach the ears of the general public, but which are a great testimony to the care and alertness with which railway servants carry out their important duties.

CHAPTER XIII.

A LOOK ROUND A RAILWAY PORT.

It is a commonplace to say that Great Britain owes her commanding commercial position to her great Shipping industry. From all points of the compass ships steam and sail to this little island, and boats large and small set out to places near and far. Being surrounded by water the British Isles offer excellent facilities for the development of shipping, and possessing a number of natural harbours and splendid river estuaries the coast abounds with large and well-appointed ports.

Seaports, however, have not much utility unless there is an efficient system of inland transportation by which to distribute the incoming cargoes and to collect outgoing consignments. Successful ports to-day, therefore, depend in a great measure upon railway connections, and it is also safe to say, on the other hand, that many railways rely largely upon import and export trade. They are interdependent.

Railway Seaport Developments.

London, the greatest port in the world, was an important centre of sea-going trade long before

the advent of railways or canals in this country, owing to its geographical position near to the Continent, which even the Romans quickly recognized. There are other ports, however, which owe their importance chiefly to the enterprise of railway companies. The Great Central Railway has fostered and developed Great Grimsby enormously, and has assisted to raise it to the proud position

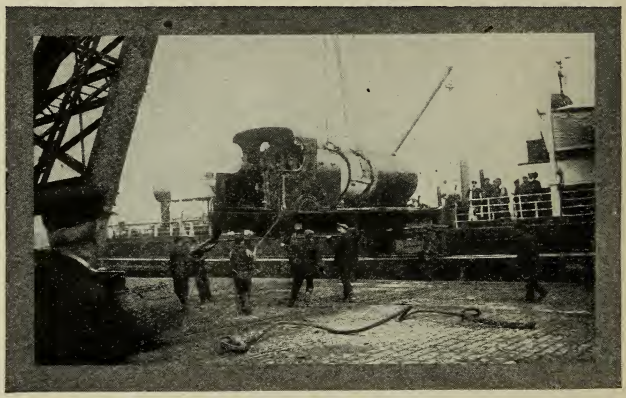
Constructing a Dock.

of the foremost fishing port in the world. At Immingham, on the River Humber, this railway company built and opened so recently as 1912 a large dock which shows great promise of development. Where to-day there is a handful of houses in a few years' time will surely be a town.

The Lancashire and Yorkshire at Goole and Fleetwood, the North Eastern at Hull, the Great

Western at Bristol and the Great Eastern at Harwich, to name only a few instances, can rightly claim credit for the importance of these towns as seaports.

The railway companies provide every facility for loading and unloading cargoes, and in the case of perishable traffic, particularly, the speed with which the produce is taken from the holds of

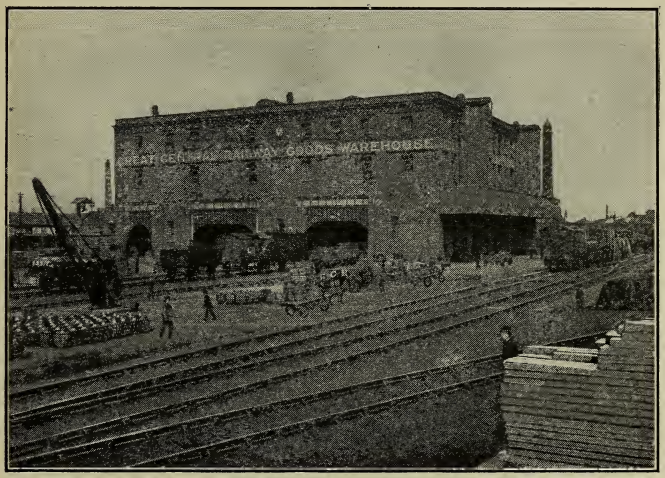


A British Locomotive for Overseas.

the vessels to destinations all over the country is amazing. Goods which have taken weeks to transport across the seas from Australia, New Zealand, China and South America, in a few hours after arrival in this country are being unpacked in the shops of the towns and cities.

There is plenty of bustle but no confusion. The incoming ships have their particular berths

in the docks and those leaving with England's manufactures have allotted places in another part of the port. Large sheds are built on the dock sides where the goods are sorted for the different vessels, or, in another section, for the inland trains.



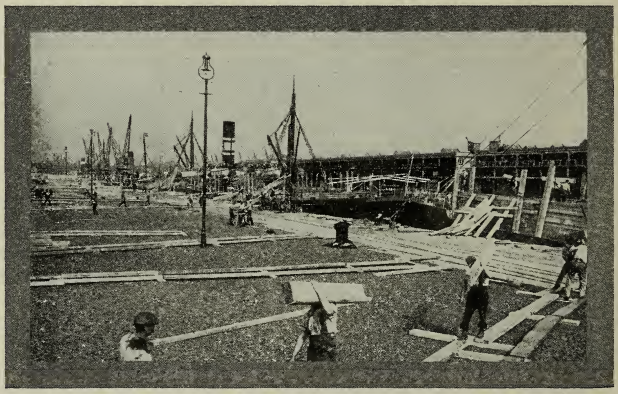
A large Goods Warehouse at a Seaport.

Where specially large quantities of one commodity are dealt with at a port it is usual to construct separate docks for the traffic. Thus, a port may have a dock for general cargoes, a fish dock or docks, a timber dock, and a grain dock.

Arrival of Timber and Fish.

Round about the timber dock merchants rent ground spaces, and when the Baltic Sea is free from ice and the season is in full swing huge

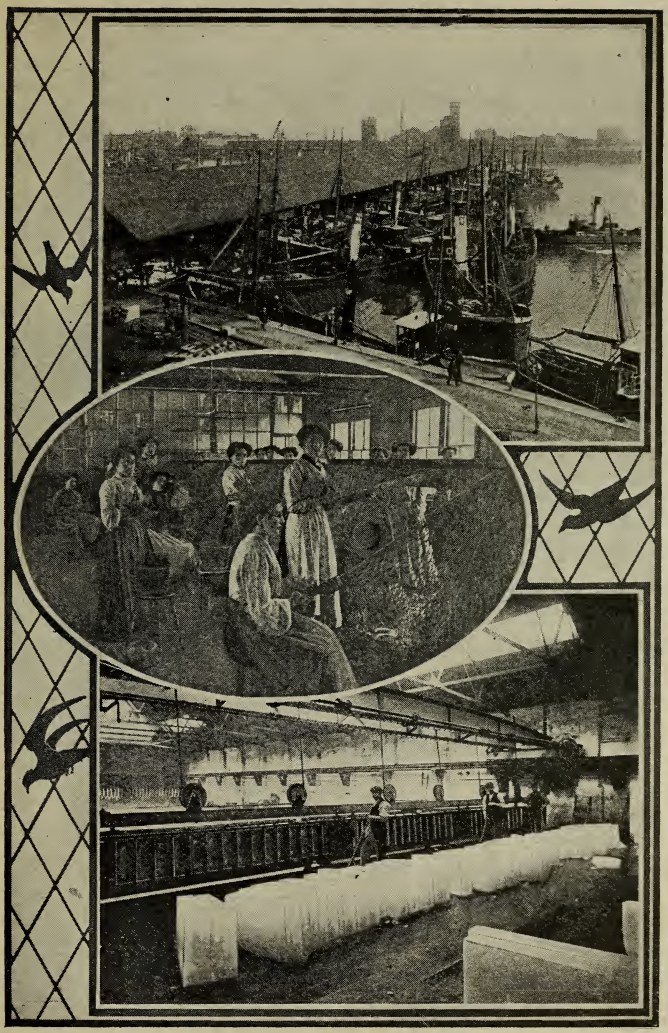
and continuous stacks rear up all round the dock, and the private yards close by are packed with timber. Mining timber is usually stored in the water, and is formed into large rafts, whilst railway sleepers and baulks of oak are similarly stored in the water, and taken out as required.



Unloading Timber.

Dealing with fish, the spoil of the sea, is an interesting operation. The hardy men who have been out with their steam trawlers on the Dogger Bank, round the Faroe Islands, or Iceland, facing the perils of the deep, on returning to port look for signals, to tell them whether the lock gates are open and if they may enter to discharge their catch on the quayside.[1]

[1] The lock gates leading to the docks are opened when the tide is sufficiently high to admit of vessels passing through from the river or sea to the dock on one water level. At some ports vessels can enter at any state of the tide.



1. Steam Fishing Trawlers at the Jetty
2. Mending the Trawling Nets.
3. Manufacturing Ice.

At certain places a ball or a diamond-shape hoisted to a mast in the daytime or a green light during the dark hours denotes that the way in is clear.

There is generally an exciting boatrace for the dock entrance in order to obtain the best berths. When the boats are settled in position men known as "markers" allot spaces on the fish market at the quayside to each vessel according to the size of the catch. The work of unloading the fish is carried out rapidly. The top hatches on deck are taken off and baskets, lowered into the holds, are filled with fish and hauled up again by means of pulleys and chains on to the quay. Cod, plaice, halibut, haddocks, skate and dabs are set out and displayed on the stone floor of the market, and if the results of the fishing have been satisfactory the sight is a remarkable one.

Selling and Sending the Fish.

The fish is sold by auction, which begins amidst a babel of voices from all parts of the shed, and it is this "bidding" which determines the price of sale in the shops of the towns. As the sales proceed boxes are brought out, the fish is packed up, whilst ice, manufactured by special machinery at an adjacent factory—an important improvement—is sprinkled in the boxes and kits amongst the fish to help to keep it fresh. When filled and labelled the boxes and kits are wheeled away on

trucks or barrows to the railway vans standing on the rails at the opposite side of the platform.

These fish-boxes and kits are despatched by goods, special fish, or passenger trains. The fish trains are composed of vans constructed solely for carrying fish, and being fitted with continuous brakes are able to be run at the speed of express

Selling a Big Catch of Cod.

trains as there is no difficulty in bringing them quickly to rest at stations or danger signals.

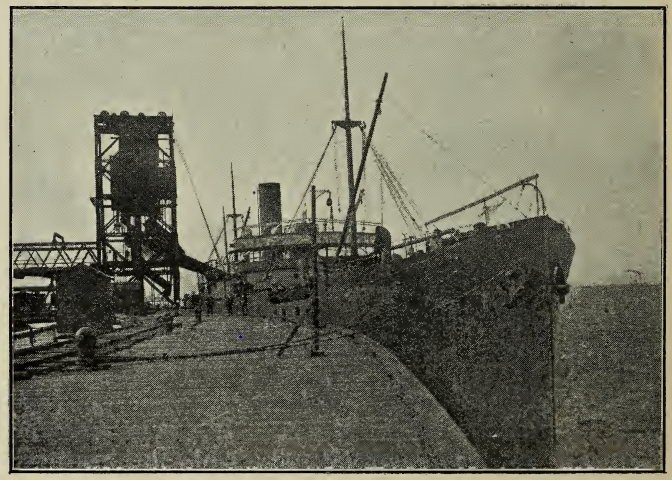
A very large trade has developed in supplying fish direct to consumers in small basses. These basses are loaded up into the brakes of passenger trains at the Dock passenger station, and are carried by rail to all parts of the kingdom.

Water-boats steam round the docks and furnish

the trawlers with the necessary supplies of fresh water for the boilers and drinking purposes in readiness for the next trip.

Loading the Coal into Vessels.

Coaling is a noteworthy feature. Steamships require coal for the bunkers to raise steam to drive



Tipping the Coal into the Ship's Bunkers.

the ship, and a port would be incomplete without arrangements for coaling the outgoing vessels. From this country a large number of vessels carry coal as cargoes, particularly to France and Italy.

The coal is brought to the port from the collieries in full train-loads and the contents of the wagons are transferred to the vessels by various

methods. The most effective is the "wagon tippler" arrangement. The wagon is run into a hoist, lifted, and the contents tipped into a shoot the end of which is over the hold of the ship. The empty wagon is run back on the higher level along a road which slopes downward, and the hoist is lowered to take up another wagon of coal. The work is very rapidly performed.

Dock Passenger Stations.

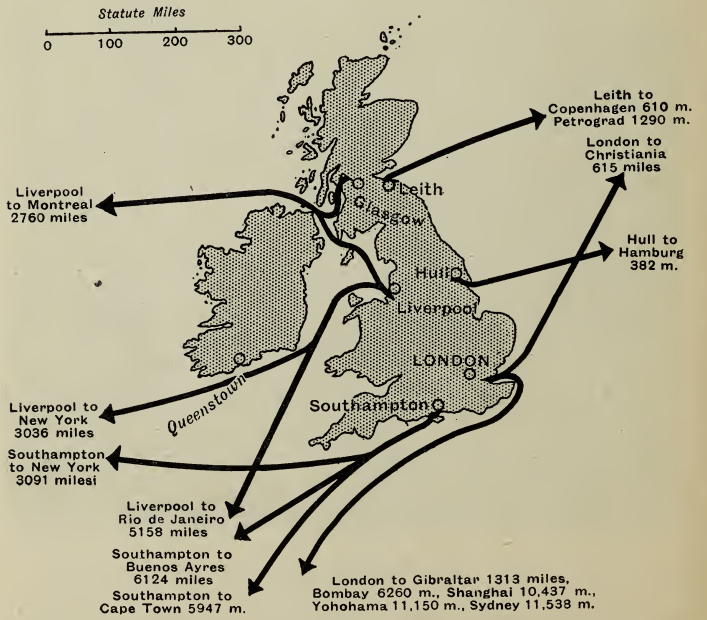
Catering for passenger travel to and from seaports has become a fine art. Express passenger

The Express brings Passengers direct to the Quayside.

trains run right on to jetties or landing-stages, some of which reach out beyond the docks into

the open sea or river. The passengers simply step from the compartment of the train to the side of the steamer which is to carry them 200 or perhaps 6000 miles across sea or ocean.

Passengers arriving from distant countries find that the boat which has borne them for several days, or it may be weeks, has drawn up close to a railway passenger station, and in a few minutes they are comfortably installed in well-appointed coaches, which will shortly carry them across country towards their ultimate destination.

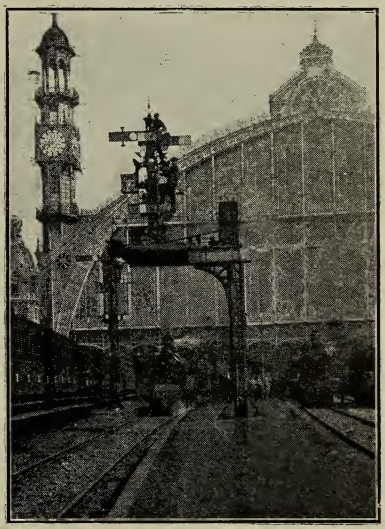


Principal British Ports and their Overseas Trading Centres

CHAPTER XIV.

A FEW REMARKS ABOUT RAILWAYS IN OTHER COUNTRIES.

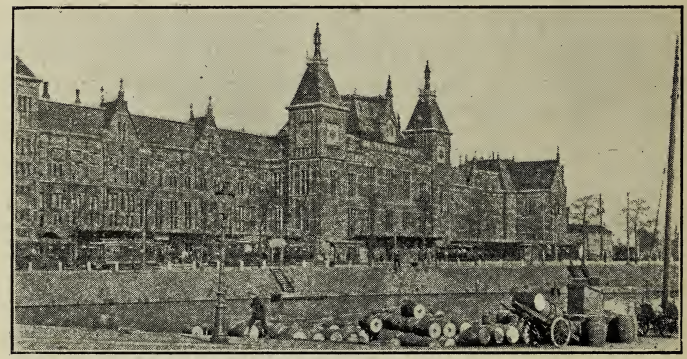
ALTHOUGH the first public railway in the world was constructed in England, certain other countries were not slow to follow the British example. In 1828, before the Liverpool and Manchester Railway was completed, France and Austria had each opened a public railway, whilst in the following year the United States introduced steam traction. Germany and Belgium quickly followed the lead, and in 1838 Russian engineers, having witnessed the wonderful performances of Stephenson's locomotives



Signals inside a Large Continental Station.

on British railways, provided their mighty empire with an iron railroad.

Sweden was somewhat late in adopting the new form of transport, and it was not until 1851 that railways were started. New countries like Canada and Australia were naturally behind the European countries, and it was not until the

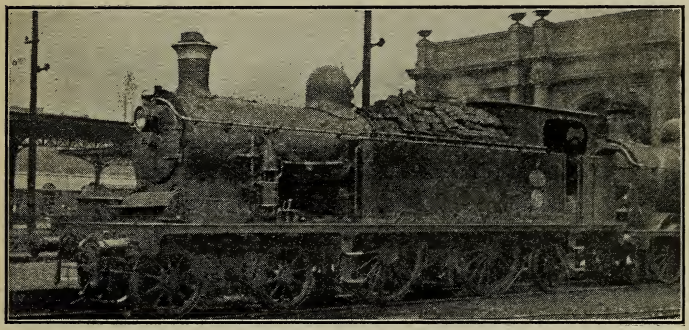


State Railway Stations are very large. Central Station, Amsterdam.

early 'fifties that the iron horse commenced to work for the Canadian and Australian colonists.

The Japanese were content to make the best possible use of old methods of carriage, but in 1872 the improved system of carriage by steam locomotive found its way into their country. Although early makers of canals, the Chinese were in no hurry to adopt steam locomotives, and continued to be satisfied with rickshaws

and canals. At last, when many of the locomotives in England had been placed on the retired list after long and faithful service, the



Belgian State Railway Engine. Bricquettes are burned. They can be seen piled on the top of the Boiler.

Chinese decided in 1887 to fall into line with the other nations.

Some Continental Lines.

As indicated, the French made an early start with railways, but they did not exhibit any great haste in developing the invention. The country possessed good rivers, many canals, and an excellent system of roads, and, as the French had not to face the same transport problems as Englishmen, they were somewhat later in developing railways on a large scale.

The French railways follow a similar plan to that of the roads. They branch in different directions and each has a separate district to cater for. The "Northern" covers a territory to the

The Railway Systems of France.

Northern Railway of France. Express nearing Calais.

north of France with a close network of railways. Its traffic is greater than the others, in that it serves a small but very populous, fertile, and industrial region. The Paris, Lyons, and Mediterranean runs south from Paris through Lyons to Marseilles and is a very important railway. The other railway systems are the Eastern, Southern, Paris-Orleans, and the Western State Railways.

The Switzerland Express, travelling at a high speed.

The position in France is a peculiar one. The State built the railways and then left them in the hands of private companies to work and maintain.

Paris is an important railway centre, and there are a number of long train runs from the French Capital, crossing the European continent, chief of which are—

Paris to Berlin (665 miles)	Passing through Cologne, Dusseldorf and Magdeburg.
Paris to Vienna (870 miles)	By Mainz, Frankfort, Nuremburg, Ratisbon, Linz.

Paris to Constantinople (Orient Express, 1949 miles)	Passes Epernay, Chalons, Nancy, Strassburg, Stuttgart, Augsburg, Munich, Linz, Vienna, Budapest, Belgrade and Nish.
Paris to Madrid . . (792 miles)	Orleans, Tours, Poitiers, Bordeaux, Bayonne, Burges, Valladolid.
Paris to Milan . . (519 miles)	Through Dijon, Pontarlier, Lausanne, Brieg (pierces Alps by Simplon Tunnel 12¼ miles long).
Paris to Brindisi . . (1161 miles)	By Chambéry (crossing Alps by Mont Cenis Tunnel, 7¾ miles long), Turin, Piacenza, Bologna and Ancona.
Paris to Athens . . (new route)	Milan, Venice, Trieste, Agram, Nish, Uskub and Larissa.

NOTE.—In the journey from Paris to Madrid passengers and goods have to be transferred at the Franco-Spanish frontier, owing to a difference in the width of the railroads. The width of the Spanish lines is 5½ feet, and the French 4 feet 8½ inches.

The railways of Germany belong principally to the State, and have been laid mainly with a view to military efficiency. There is scarcely any point in Germany which cannot be reached in one day from Berlin. The traders of the country, however, are urged to make greater use of the canals and rivers.

Berlin to Trieste . . (514 miles)	Via Vienna.
Berlin to Petrograd . (984 miles)	Konigsberg, Vilna and Dvinsk.

Berlin to Baghdad . The Turkish Government gave permission for Germany to construct a railway from Scutari to Baghdad. The railway was begun from Haidar Pasha opposite Constantinople, and the German hope was ultimately to run through trains from Berlin to Vienna, Budapest, Belgrade, Nish, Constantinople, across the straits to Haidar Pasha, and thence to Baghdad.

Principal European Railways.

The Hartz Mountains and the Alps offer a serious hindrance to German railway communications.

Russia has not made very great progress with railway construction, particularly where there is a difficulty in obtaining the necessary supplies of material for railroad building, and those which have been built are mainly composed of a single track. Russia does possess, however, one of the longest lines in the world, the Trans-Siberian Railway, which crosses the whole of European and Asiatic Russia, finishing at Vladivostok on

the Pacific. Moscow is the greatest centre of railway communications in Russia.

From Esbjerg (Denmark) there is a rapid route to Copenhagen and the South of Sweden. Sleeping cars are transported by means of train ferries across the Little Belt from Jutland to Fyen and across the Great Belt from Fyen to Seeland and

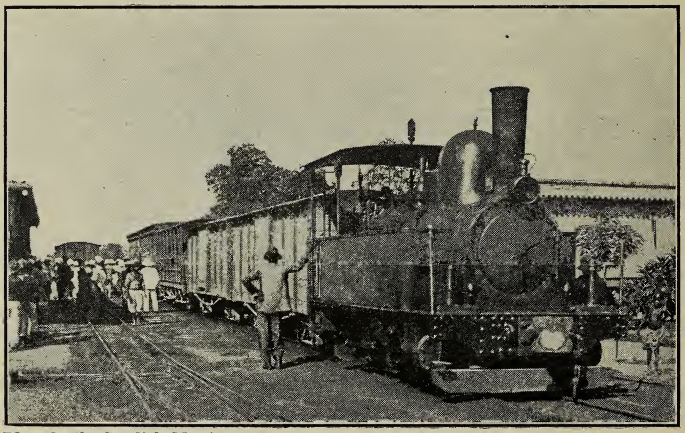


Photo by the Swedish Mission.

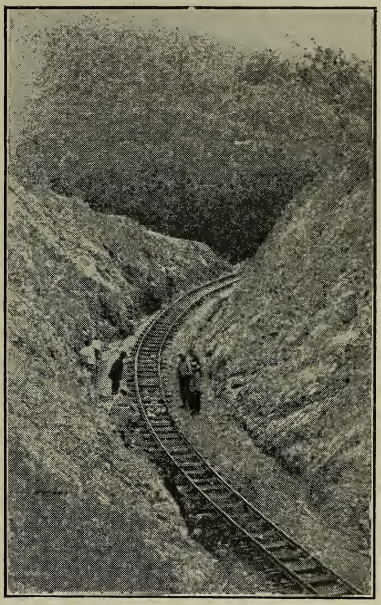
A Congo Railway Station.

Copenhagen, and by way of the Sound to Malmo. It is principally by this route that large quantities of dairy produce are brought to England, travelling by sea from Esbjerg to Harwich.

African Advancement.

Important advances have been made in Africa; the railway from the Cape of Good Hope in the

extreme south to Cairo on the Mediterranean, crossing from one end of the Continent to the other, will, when completed, give a great impetus to the African trade. This railway is the prolongation of the Nile Valley and Cape-Rhodesia railways.



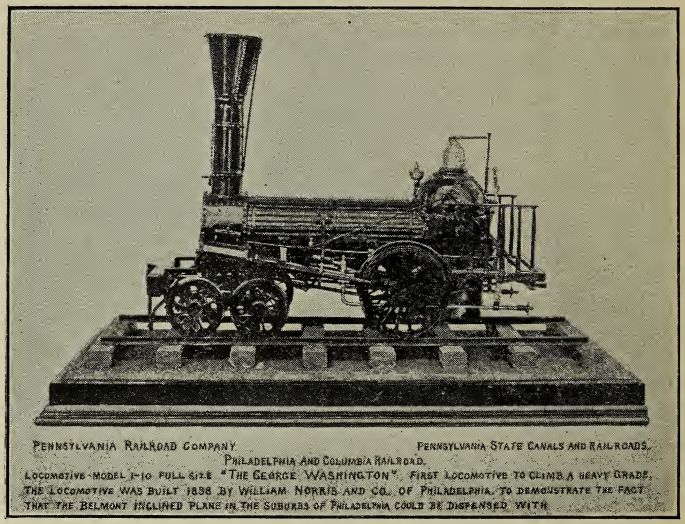
Belgian Government Photo.
A Sharp Curve on the Congo Line.

The Nigerian railways are developing, and the iron road is gradually modernizing the means of transport in the African Congo, where useful railways are greatly assisting the work of collection and distribution, and the natives in European costumes have been trained as drivers, firemen, guards, shunters, and in several other railway occupations.

The American Railroads.

Very great interest is centred in the railroads of the United States, of which there are nearly 250,000 miles in operation. The nation lives up

to its reputation of doing big things. The wagons are three and four times larger than the average

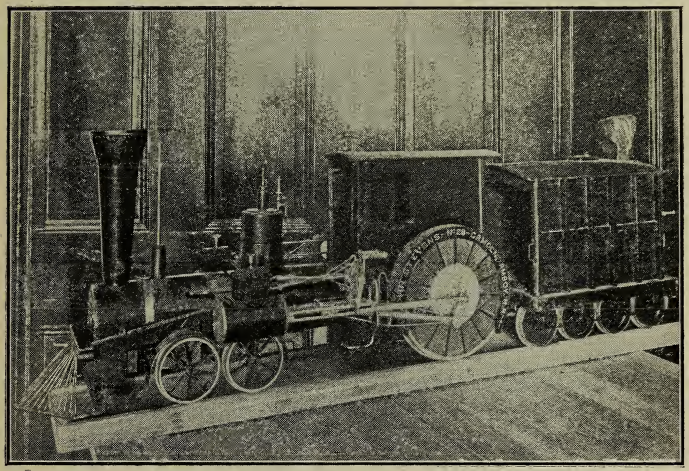


"John Bull and Train." One of the First American Trains.

truck on British railways. Their locomotives are bigger and heavier than those of most other countries, and a number of the long journeys

each covers thousands of miles occupying many days.

Travelling in America is very often luxurious. A train which ran between New York and Chicago carried more railway servants than passengers. The train was fitted with bath and smoke rooms,

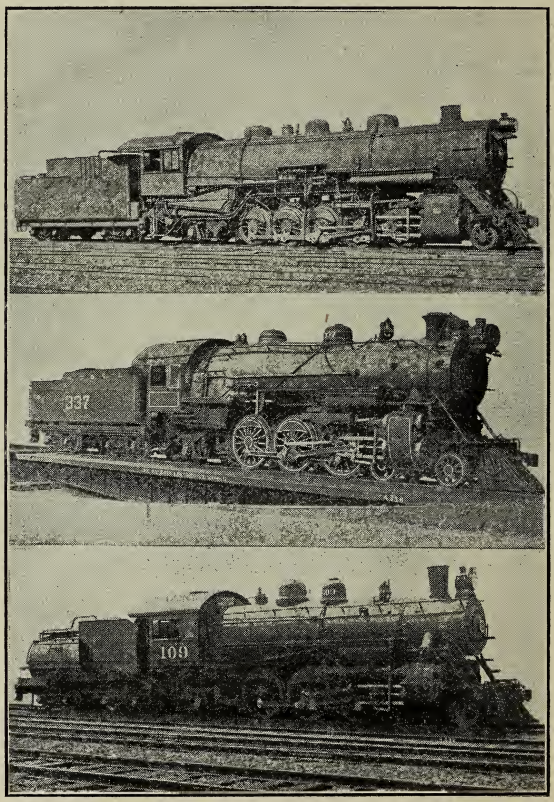


One of America's First Engines. "John Stevens."

library, business room, where a shorthand typist was in attendance to write letters for business men, a ladies' saloon, refreshment car and even a barber's shop.

The Northern Pacific, the Union Pacific and Southern Pacific are three chief trans-continental railways running from the Atlantic seaboard to the Pacific.

The Union Pacific Railroad, running from New York to San Francisco, was the first to connect the two great oceans.



Three Huge American Locomotives.

The Canadian Pacific is an important railway. This route offers the shortest line across the whole

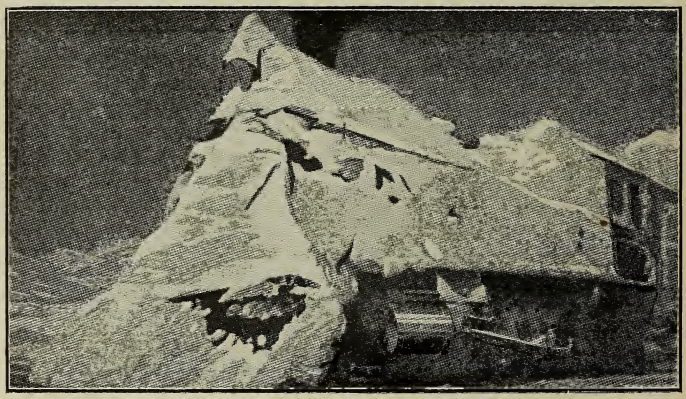
American continent and, with the Grand Trunk and others, provides Canada with an important transport system.

One of America's wonder railways is that

Some Great Railways of the World.
(Drawn on a uniform scale.)

over the White Pass to Yukon in Alaska. Its scenery is magnificent. Tunnels have been hewn

and bored through hard rock; the whole country was a wilderness of steep mountains, and the work of construction was attended with enormous difficulties. The snowfalls are much heavier than can be realized by dwellers in temperate climes, and the digging out of a train which is "snowed



The Snowfalls are so heavy that even the heated Engine becomes almost covered.

up" calls for great exertion and continuous toil. Often, when the huge engine wheels have been cleared, dense clouds of snow will be blown by the blizzard, and the arduous labour recommences.

Railway development is rapid in South America: the Argentine Republic in particular having an important network of railways. The railway from Buenos Ayres to Valparaiso, another highway joining the Atlantic and Pacific, viz. the

Trans-Andine Railway, is worthy of special note because it pierces the lofty mountain ranges of the Andes.

Colonial Railways.

Australia suffers from an unfortunate circumstance. Different widths of lines have been adopted. Those of South Australia and Victoria are 5′ 3″ wide, New South Wales 4′ 8½″, and the remainder the narrow 3′ 6″ gauge.

Important developments have taken place in railway construction in recent years, more than 1000 miles of line being opened for traffic during the years 1911 and 1912 in the Queensland State alone. The total length of the Australian railways is considerably over 16,000 miles.

In order to obtain the full benefit of the Australian inland transport, it may become necessary to adopt a standard gauge for all lines as the English railways were ultimately forced to do.

With the exception of a few short lines used for agricultural purposes the railways of Egypt are owned by the State, and in India also the Government are rapidly becoming owners of the greater proportion of the railways of this peninsula. The railroads are assisting considerably to develop the resources of this wonderful country, but here again the disadvantages of different sizes of rail gauge are apparent.

The present tendency in the empires of the

Chinese and Japanese peoples is for the respective Governments to acquire the railways. Construction in China is proceeding at a rapid rate, and, although there are something like 3000 miles of railway in Japan under the control of private companies, the probability is that ultimately all lines will come under the working of the Imperial Government.

Great Britain and America stand out pre-eminently as the two countries of the world where the whole of the railways are owned and worked by private enterprise, and whatever may be the arguments in favour or against the State ownership of railways, it cannot be gainsaid but that Great Britain and the United States have thrived exceedingly under private ownership.

CHAPTER XV.

TRANSPORT IN WAR TIME.

THE great European War, which broke out in August, 1914, and which afterwards spread practically throughout the world, caused many changes to take place in the transport world.

One of the first acts of the British Government on the declaration of war was to take over the control of British railways, and to issue instructions that they were to be worked for the benefit of the State in its intention to carry the war to a successful conclusion, and that the convenience of the public must become a secondary consideration. Soldiers were sent to different parts of the railroads to guard the lines against enemy action, as it was important that no interference should take place with the rapid transport of troops and war materials. Competition between railway companies was suspended, and all traffic had to be carried to the best possible national advantage over all railway companies' lines. Canvassing temporarily came to an end.

Huge quantities of munitions were manufactured and had to be transported to the various theatres of war, i.e. France, Belgium, Italy,

Russia, Gallipoli, Palestine, Egypt, and Mesopotamia; armies had to be carried to training camps and to the various battle fronts, whilst enormous quantities of foodstuffs to feed the troops were required abroad. The traffic on the railways in France was very heavy, as they had to deal with the ever-growing British army in addition to their own. No wonder then that the locomotives, carriages and wagons on the French railways proved insufficient to cope properly with the requirements. Engines and wagons, therefore, had to be taken from this country over the seas to France, and new railways being urgently needed miles of British rails were torn up and sent across the Channel.

An innovation introduced during the War in connection with British transport was the establishment of train ferries across the English Channel between the southern ports and France in order to save the double disembarkation.

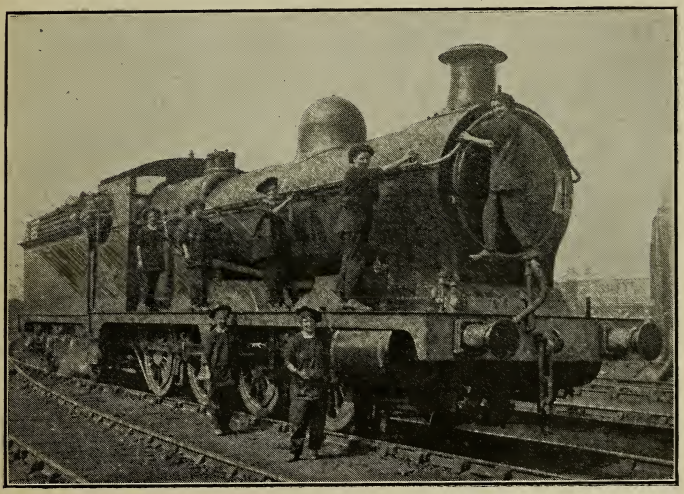
The war rail traffic continued to increase so rapidly that the burden became overwhelming, and it was decided that the public would have to be satisfied with fewer facilities, and that pleasure travelling should be discouraged. To further this object fares were raised, the sending of "luggage in advance" was suspended, and the running of cheap excursion trains for the time being disappeared, whilst many ordinary trains were discontinued.

The demand for men for the expeditionary

forces made a drain upon the employés on the railways, and in every department where men could possibly be released the physically fit were liberated for the forces.

Female Railway Workers.

The railways, therefore, could not carry on efficiently in the absence of such large numbers of



Helping to clean the Locomotives in War Time.

servants, and the companies had to resort to the employment of females, and thus a new element came into railway work. Many clerks, station porters, ticket collectors, dining-car attendants, goods porters, van drivers, carriage cleaners, engine cleaners, and shed sweepers were released, and their

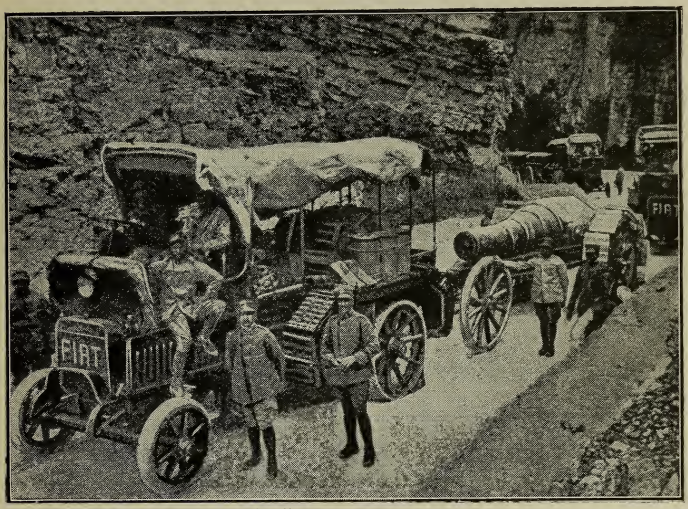
places taken by women workers, who, in most of the grades, have proved that there are duties in the realm of transport which women and girls can perform efficiently.

The reputation of British railways for rapid despatch and delivery of merchandise suffered a decided set-back during the war. At certain periods, changes in the war situation rendered it necessary that special efforts should be made to carry large numbers of troops from the home encampments to the scene of action in great haste, together with immense quantities of motors, guns, tanks, shells and aeroplanes. Ordinary goods and passenger traffic had to wait for more favourable circumstances, and thus much traffic remained uncollected for days together.

War Transport on the Roads and Canals.

To maintain the trade of the country and to facilitate war work the Government decided that the canals and rivers should bear a larger proportion of the burden, and an Inland Water Transport Board was appointed to arrange for improved working. Further efforts became necessary, and a Road Transport Board was introduced with powers to restrict the road transport and to use whatever vehicles they needed for war work. Heavy motor lorries began to convey unfinished munitions from one works to another, and the completed weapons of war to the stores, and even to the ports.

The railways alone performed miracles, and by making more use of the waterways and roads Great Britain was able to maintain an army of several millions in different parts of the world,



By permission of "Motor Traction."
Italians cut a Road out of the Rock to transport Guns and Material to the top of the High Mountains.

supplying it with food, clothing and everything necessary to wage a victorious war.

Military Roads and Railways.

The battle front in France extended for a length of 300 miles, and there was an unbroken line of soldiers from the Belgian coast to Switzerland. All these men had to be supplied with food and munitions, and from time to time they had to

be relieved and taken into rest-camps. To enable all this work to be effectively performed a number of narrow light railways were constructed, most of them resembling the toy railways in England. Not all the work, however, could be performed by means of railways. Fleets of motor lorries and 'buses proved of great utility, many of these 'buses having already done good service for the public in the streets of London. To accommodate these vehicles new roads had to be made, and this work in many places was a big undertaking, particularly in some parts of the Italian battle front, and in the Alps, where the roads had to be cut out of the face of the rock.

Hospital Ships and Ambulance Trains.

Special care had to be taken of the wounded, and in order to bring them rapidly to the base hospitals in France and to the hospital ships for home, hospital trains were fitted in a most excellent manner, which swiftly conveyed their precious freight to the base hospitals and infirmaries or to the ports. On arrival in English ports the hospital ships were met by ambulance trains, and the wounded soldiers were rapidly distributed amongst the various towns throughout the country. Many men who possessed private motor cars performed voluntarily much excellent service by meeting these ambulance trains at the stations and conveying the wounded speedily to the hospitals, but special motor ambulances were used for the

"stretcher cases." These ambulance trains, both for use in this country and in France, were made in the works of the various railway companies

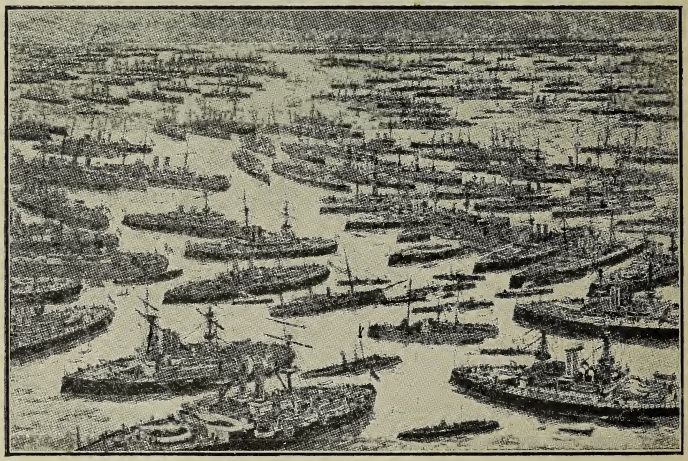
One of the First Ambulance Trains built during the Great War.

in England, and were a fine tribute to modern skill in coach designing and equipment.

In the Air and on the Water.

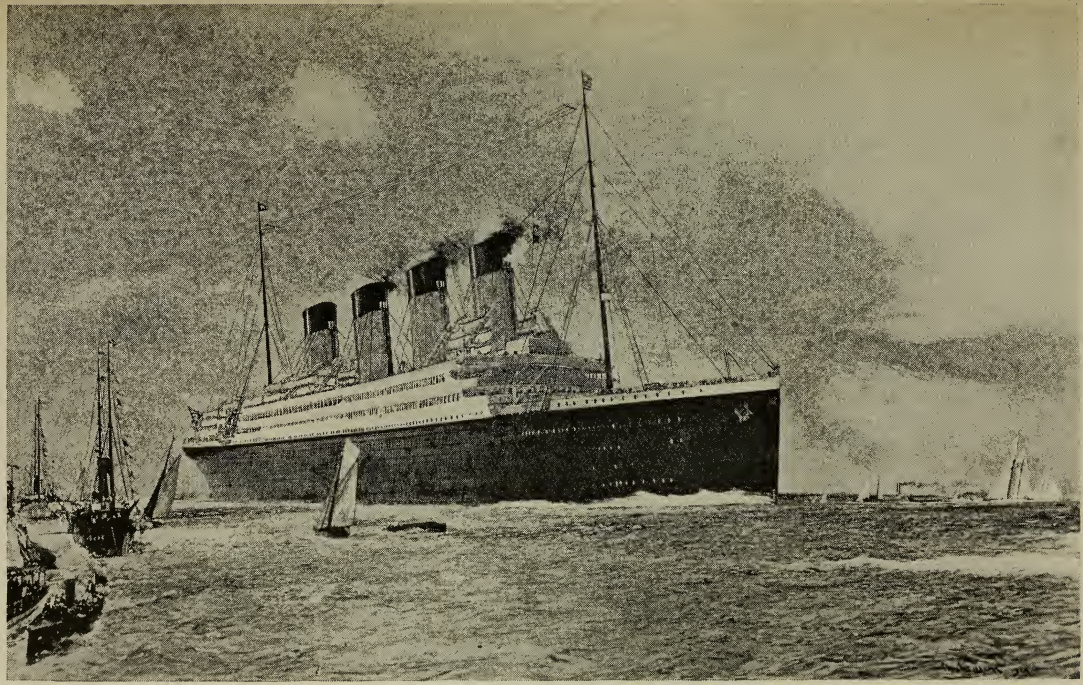
Aeroplanes played a great part in carrying out observation and in bombing enemy troops and encampments. In some cases also they carried out transport work which would not otherwise have been possible. General Townsend and his 9000 British and Indian troops in the town of Kut in Mesopotamia were surrounded by a large army of Turks, and received, during the period of enforced residence, parcels of food dropped by British airmen; the Austrians, trapped by the swollen River Piave in Italy, received food supplies from the air, thus enabling them to hold out until the river subsided.

The great and small vessels of the British Mercantile Marine and those of the allied countries, escorted by the British Navy, brought food and ammunition from distant countries navigated through many grave perils from mines and submarines.



Warships which guard the Merchant Vessels in War Time.

The "dangers of the deep" are great enough in times of peace, but during The Great War they were increased a hundredfold, and it is a striking tribute to the organization of the mercantile marine and the protective units of the Navy that transport on the seas and oceans was so efficiently performed during a remarkable period of $4\frac{1}{4}$ years.



"The Britannic." "Sunk on the 21st November, 1916, by German Submarine whilst serving as a Hospital Ship, the vessel bearing all the Distinctive Marks required to show the character of her employment. Loss of life: Medical Staff 8; Crew 21."

CHAPTER XVI.

A PEEP INTO THE FUTURE.

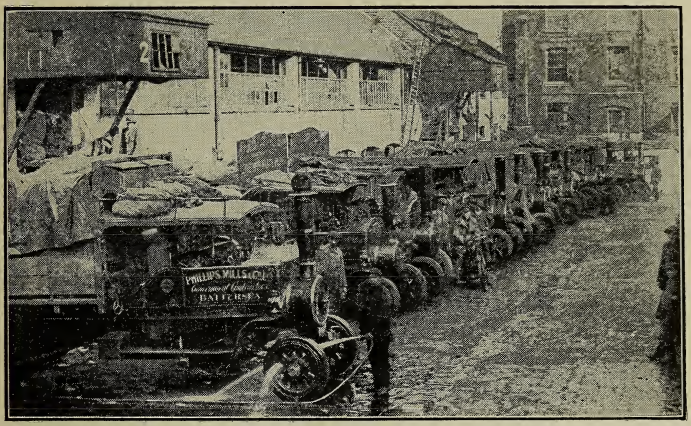
Man is naturally progressive. To stand still is monotony. Some advanced thinkers say that humanity will continue to progress until a point will be reached which will be the limit of advancement, and the monotony will only be relieved by sliding backward. Even if such a theory be true, the time is not yet; there is still much to be accomplished, and in the realm of transport, as in other branches of science and industry, there are indications of the direction in which the improvements will be made.

The Development of the Roads.

Self-propelled heavy road vehicles are comparatively new; there is room for much development. The jogging along at from five to fifteen miles an hour dragging a trailer, and making a great noise, is only comparable with the earlier locomotive engines. A more powerful road wagon will take its place, the speed and the loads will be increased, and instead of a single wagon, with perhaps a trailer, will be seen fast tractors with a

stream of vehicles following. It is not unlikely that a guard of the road train will be seen in the rear wagon.

There are difficulties certainly. The country roads are mostly narrow: they ramble over hill and dale: they twist and turn, which is a great danger to long trains, and, the worst feature of



By permission of "Motor Traction."

On the Roads Steam Tractors will carry much Merchandise.

all, the common roads are the public highway, and regard must be had for human life. As in American cities, probably, the fast traffic will travel in the centre of the road, and slower moving vehicles nearest to the footpaths.

The roadways will be improved by widening and straightening, avoiding the bad sections by cutting wider lengths, and an endeavour will

be made as far as possible to avoid steep climbs and rapid descents in the roads. There are already suggestions to unearth many of the Roman roads, which were cut straight through forests, woods and plantations, of which little trace is now visible, and on the ruins of the old build newer, stronger, smoother and wider roads which will admit of greater speed and safety for fast motor traffic.

It will probably be found practical to set aside open spaces in the vicinity of large and small towns, or even villages where through road trains will pick up and leave off trailer wagons.

Faster and lighter motors may find plenty of employment in carrying on a "small parcels" traffic between cities, towns and villages. Buildings as collecting stations, possibly, may be specially constructed in the more thickly populated areas, and agencies set up in shops on the main roads in villages which will be a great advance on the system of country carts calling once each week from neighbouring towns.

To meet the demands of passengers the electric tramway systems will continue to extend further and further away from the town centres and the adjacent suburbs, and in time no doubt all the towns will be linked up. There is, also, the bicycle. Who can tell what the alterations in this machine will be. Great improvements have been made since the days of the big and little wheelers, and considerable headway may be anticipated to render it an easy and cheap means of travelling.

The stone roads without doubt show promise of becoming busier.

Improving Inland Waterways.

The canals in this country at present bear the same comparison to the railways for speedy transit as the tortoise does to the hare. But there is a hue and cry for the ancient order of things to be done away. If the present believers in canal transport accomplish their desire another generation will reveal great changes.

Many Canals will need to be widened.

The old plodding horses are to disappear from the towing paths of the canals, they will not be needed. Swifter moving barges, forced along by motor, are expected to take the places of the sleepy looking boats which now move forward at about three miles an hour. The dry beds are to contain water once more. The long tunnels, where it is possible, are to be avoided, and cuttings will take their places. Those canals which have become almost filled with mud and silt through inattention are to be dredged and cleaned, and narrow waterways are to be widened. The sides of the

canals, which in places would soon be broken away by the wash of the water from faster craft, will be strengthened. Instead of the sight of single boats, moving so slowly that from a distance they scarcely seem to have motion at all, possibly trains of boats fastened together will move in businesslike manner along broad streams. Such revolutionary changes will involve enormous sums of money.

Some of those short canals, altogether useless for purposes of commerce as canals, having no connection with others, may be drained and perhaps used as roadways.

There is a proposition to construct new canals spoken of as the "cross" scheme, and to improve others, which will link up the rivers Mersey, Severn, Thames and Humber. It is now expected to cost some £40,000,000, but a few more years may see the commencement of this or some similar but less ambitious scheme in order to obtain greater use from the existing waterways.

On the High Seas.

And the ocean steamers. The last word in shipbuilding has not yet been spoken. The intention of moving as much traffic and as many passengers in one journey as possible will be kept in view, and the rising generation will see even greater goliaths being towed from the landing stages, which will travel at many more knots

per hour than have yet been obtained from vessels already built. With increased speed the far-distant places will appear much nearer, and greater numbers of people will travel. Some inventive genius may construct a ship which will materially lessen the horrors of sea-sickness, and make for sea travel a more welcome form of transport.

In the Northern Hemisphere one of the gravest dangers to ships travelling at night or in foggy weather is from floating icebergs. There is already an appliance being perfected, which it is believed will warn ships' captains, in ample time, of the vicinity of icebergs: vessels fitted with such instruments will no longer be in danger of disasters such as overtook the ill-fated *Titanic*, that mammoth White Star liner which took so many to an ocean grave.

Under the Water.

What boundless possibilities there are before underwater craft time alone can show. Though submarines were introduced for destructive purposes there is surely no reason why they should not be utilized for constructive objects. Already from a small beginning rapid strides have been made, and larger and more commodious under-sea boats are being constructed.

The River St. Lawrence, the Baltic Sea and the White Sea (north of Russia), as well as other waters, are frozen over at certain parts of the year,

and shipping cannot be carried on at the seaports. May it not prove that large submarine merchant vessels will be able to submerge and, travelling beneath the ice, rise to the surface again when arriving at a spot, near the port, which has been

Submarine.

kept clear of ice? Greater wonders have been performed.

Many people are debarred from travelling on the sea owing to suffering greatly from sea-sickness. There are no storms below. Submarines may assist such people to journey in comfort to foreign shores.

The Future of Railways.

What place will our iron railroads occupy in the transport of the future? There are those who believe that the steam locomotive has accomplished its greatest performances, and will fail

to keep pace with the demands of modern transport, and that some other agent must shortly take its place. Railway engineers have not, however, by any means achieved the last of their triumphs, and, in addition to those inventions only yet in their infancy, will record many notable accomplishments.

In spite of probable improvements in road transport or changes on the canal, there will still remain an enormous amount of traffic which must go by rail. Trade will grow, and the amount to be hauled along the railroads will increase also.

Where there is now only one set of rails, and all trains have to be run on one line, another will be added, making a double road, two roads will be multiplied until we have four, six, or even perhaps eight parallel running tracks. Very fast expresses will take the centre in each direction, the slower trains the next outside, and still further away the heavy mineral trains.

Danger from train accidents will be lessened. When a driver by mistake passes a danger signal automatic train-stops will bring the train to a stand before any damage is done. Patent shock-absorbers at the end of coaches will in the case of collision remove the danger of coaches telescoping one into the other. Level road crossings on railways will, in the majority of cases, disappear. They will either be lowered to go underneath the line or be carried by a bridge overhead, fatalities at level crossings thus being avoided. Carriage

doors will be locked by a contrivance which will make it impossible for a passenger to open the outer door in mistake for a corridor door, whilst the train is travelling.

Engines will be larger and more powerful, and it will not always be necessary to have the finest steam coal for the fires, as even the coal-dust will be burned with good results ; wagons will increase in size ; more through trains will run from one end of the country to the other and there will be less need for changing to reach destinations. Could that great railwayman, Sir Edward Watkin, have lived another thirty years, he would no doubt have seen his scheme of a tunnel bored under the Straits of Dover an accomplished fact, whilst a railway will in time, possibly, run under the Gibraltar Straits to Africa, and the projected tunnels under the Irish Sea and the Behring Strait may be bored at some not distant future.

It does not now require a great stretch of imagination to see passengers who have travelled by rail from Capetown stepping from trains in London, or for the Russians in Petrograd to observe Scotchmen who have travelled overland from Aberdeen hurrying along their railway platforms. Chinese in Peking will unload cotton goods from English railway wagons which have not been near a steamer. The Egyptian cotton planters may send some of their raw material to Lancashire hauled the whole way by the iron horse.

To achieve this revolution greater alterations

will need to be made than may appear. It will be necessary to bring the different widths of line to a common standard, as the wagons of Britain could not travel on the wide railways of Russia, nor could the broad vehicles on the Spanish railways pass through English tunnels.

But it is not to be all steam locomotives: electricity is bound to play a very important part in future transport arrangements. Already electric trains are very numerous in the localities of large cities, particularly London and New York. Electricity offers great possibilities for local passenger train services, and eventually people, working in the town and living in the country, will be taken rapidly to and from the scene of their daily labours in electric, and not steam, trains.

Underground tubes in New York and London have proved a great success, and doubtless all the great cities of the world will in time provide their citizens with tube railways underground.

The Mono Railway.

Some transport students believe that we have not by any means reached the limit as regards speed in travelling, nor yet anything approaching to it. Eighty miles per hour is at present looked upon as the best that can be accomplished on land, and this is believed to be the extent of the powers of the steam locomotive. But the mono or single-rail idea may yet prove practical. Many years

ago it was suggested to construct a railway from Manchester to Liverpool, the scene of the Rocket's famous trials, the railway to consist of a single rail, hence the name mono-rail. Worked on this principle the promoters believed that the present best speed would be more than doubled, and passengers from Manchester would scarcely have time to seat themselves comfortably in the train and open their daily paper before they would have covered the thirty-five miles separating the two cities, to find themselves alongside the Liverpool platform. The plan proceeded no further than discussion, but it may appear again.

Another remarkable idea at a later period startled the railway world. A man named Bachelet produced, in England, a scheme by which a speed of three hundred miles an hour might be attained. Many well-known railway experts witnessed the trials with a model of this wonderful machine. From Manchester to Liverpool in seven minutes would be remarkable travelling. Imagine the remarks of the German doctor who feared the early railway travelling at twenty miles an hour!

But there is a great difference between trials with a small toy and the real thing in practice. For the time being Bachelet's invention is in abeyance.

Transport and Flight.

The infant child of transport, Aviation, has a future to be reckoned with. In speed, at present,

the flying machine is well in front of the train, more than double, in fact, and generally speaking it is several times faster than the steamer. It is in respect to the long journeys over the ocean that the advantage of the flying machine is clearly shown.

From the British Isles to America by steamer

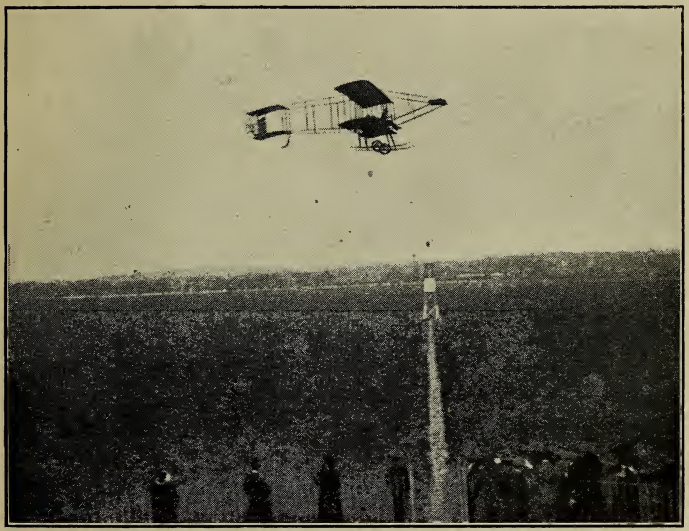


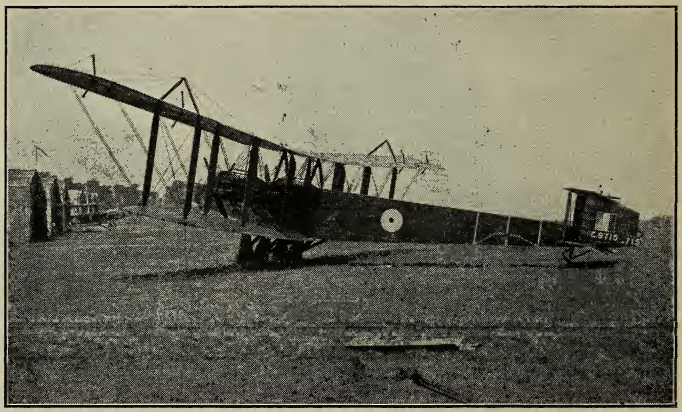
Photo: *Editor of "The Aeroplane."*

Aeroplanes will play an important part in the Transport of the Future.

at the present takes five days, but this could be accomplished by seaplane in little more than a day. To Sydney, in Australia, five weeks is allowed for the journey, but through the air less than a week would suffice.

This is a tempting prospect, and one not likely to be neglected. Overland, say from Paris to Hong Kong, the steam engine would be outclassed, and the flying boat would have completed the return journey before a locomotive had finished the outward half.

The possibilities are undeniable, but there is a great deal to be said on the other side. In the



"Handley Page" Aeroplane being fitted for carrying Passengers.

first place a seaplane could not carry two thousand passengers or thousands of tons of cargo, like a mighty ocean liner; in fact, it is difficult to see how heavy goods can be carried at all. It will only be capable of taking a comparatively small load, and the cost of transport is bound to be very high. But mails, goods of great value, and samples might reasonably expect to be carried, and already

the American and other Governments are utilizing flying machines for carrying letters and mails, and chiefly, so far as can be prophesied now, this would appear to be the special rôle of the air service—aerial post, and passenger trips.

Landing stations all over the world will be needed, to set down and pick up mails and passengers, and to obtain supplies of petrol. Sheds also will be necessary where repairs to the machines can be carried out.

Huge dirigible airships will probably go a long way towards overcoming the difficulty of heavy loads, and they may yet be seen carrying large boxes and bags across the seas and overland.

May not Arctic and Antarctic exploration be influenced by the assistance of flying machines? Travelling by sea and land has proved a difficult proposition, and air communication may prove to be a means of overcoming many of the present serious hindrances.

In England, where the distances are short compared with those in big continental countries, it is hardly likely that services between towns will be arranged, as the aerodromes will require to be out in the open, well away from towns, and anyone wishing to travel from the centre of the city will need to journey a fair distance before reaching the aeroplane departing station. But there are bound to be services from our principal cities to other countries. There are great possibilities for this type of development in transport.

CONCLUSION.

In America the "science of railroading" is adopted as a worthy profession, and the attainment to the position of Railroad President is regarded as one of the most important posts in industry. In England not so much importance has been attached to the subject, and British inland transport success is due largely to the initiative and organization of a few leaders rather than to appreciation and understanding by any number of transport workers. There is, however, a better outlook in this country.

Hitherto boys joined the railway service principally because—

1. Their elder relatives were railway servants;
2. It was practically the only employment in the district;
3. The railway offered cheap travelling to its servants and, usually, regular work;

only in a few instances do they appear to have been attracted by interest in the work.

Already many and definite signs are appearing to prove that transport will be accorded a place of greater distinction in the world of industrial employments. Educational authorities are increasing the scope of railway lectures; there is

an increasing demand for literature on the subject, of which there is now a little more variety, whilst many railway companies are offering inducements to their staffs to study the work more thoroughly.

After all, practice is only the application of correct theory. The subject is brimful of interest, and the foregoing pages are an attempt to sketch only a few of the outstanding features in various sections of transport work.

Great men of business, leading members of the British Government and economists, by their utterances, are endeavouring more and more to convince the people of these islands that the shortest and surest way to greater progress is along the lines of efficient transport, and this belief is rapidly gaining ground.

The well-being and physical comfort of humanity depend in a great measure upon the "Magic Carpet of Industry."

APPENDIX.

THE PRINCIPAL BRITISH CANALS.

Canal.	Mileage.	Main Routes of Canals.
Aire and Calder Navigation	93	Connects Goole to Castleford, Leeds and Wakefield. Also branches to Selby and Barnsley.
Basingstoke . . .	37½	From River Wey, near Byfleet, through Woking and Aldershot to Basingstoke.
Birmingham Canal Navigations	159	Form important system with numerous branches connecting Birmingham with Dudley, Wolverhampton, Walsall, Lichfield, and many other places.
Coventry . . .	32½	Passes through Coventry via Nuneaton and Atherstone to Fazeley. Has other connections.
Derby	18¼	Derby to Little Eaton. Connects with Erewash Canal at Sandiacre Junction, also at Swarkestone Junction with Trent and Mersey Canal.
Grand Canal (Ireland) .	237¾	Principal waterway from Dublin to the River Shannon.
Grand Junction . .	190	Joins River Thames at Brentford and runs to Braunston. Branches to Northampton, Buckingham and Aylesbury.
Kennet and Avon	86½	Forms a connecting link between rivers Kennet and Avon, from Reading on the Kennet to Hanham-Mills on the Avon.
Lancaster .	74	Between Kendal and Preston and a branch from Wigan to Leeds and Liverpool Canal.

Canal.	Mileage.	Main Routes of Canals.
Leeds and Liverpool. .	145	From Leeds through several important manufacturing towns, Shipley, Keighley, Nelson, Blackburn and Wigan to Liverpool.
Macclesfield . . .	26¼	Joins Peak Forest Canal at Marple and with Trent and Mersey Canal at Hall Green.
Manchester Ship Canal .	35½	From Eastham (River Mersey), near Liverpool, to Manchester.
Oxford	77½	Oxford to Hawkesbury on the Coventry Canal. Branches to Grand Junction Canal at Braunston and with River Thames at Oxford.
Rochdale . . .	35	Manchester to Rochdale, Todmorden and Sowerby Bridge.
Gloucester and Birmingham	46½	Gloucester to Sharpness and Worcester to Birmingham.
Sheffield and South Yorkshire Navigation	57	Comprises Dearne and Dove, Sheffield and Tinsley and Stainforth and Keadby Canals.
Shropshire Union . .	200	Junction with Staffordshire and Worcester Canal, Nantwich to Chester, Ellesmere and Chester, Donnington and Shrewsbury. Also Montgomeryshire Canal.
Staffordshire and Worcester	50	Junction with Trent and Mersey Canal and with River Severn at Stourport.
Trent and Mersey . .	122½	From Bridgewater Canal at Runcorn to Northwich, Stoke, Burton and River Trent.
Trent Navigation . .	68	Wilden Ferry to Gainsborough, where it joins the River Trent.
Wilts. and Berks. . .	69	Joins River Thames at Abingdon and travels through Swindon to Kennet and Avon Canal.

THE PRINCIPAL BRITISH RAILWAYS.

Railway.	Mileage.	Principal Towns Served.
London and North Western	2,015	London (Euston Station), Northampton, Coventry, Nuneaton, Wolverhampton, Birmingham, Shrewsbury, Whitchurch, Crewe, Holyhead, Manchester, Liverpool, Preston, Carlisle and Leeds.
Great Western . .	3,029	London (Paddington Station), Reading, Oxford, Worcester, Bath, Bristol, Swindon, Bournemouth, Taunton, Weymouth, Chester, Hereford, Cardiff, Swansea, Plymouth.
Midland . . .	1,520	London (St. Pancras), Northampton, Leicester, Nottingham, Sheffield, Derby, Manchester, Leeds, Birmingham, Stoke, Cheltenham, Gloucester, Bath and Carlisle.
Great Northern . .	1,033	London (King's Cross), Huntingdon, Grantham, Peterboro, Doncaster, York, Spalding, Boston, Lincoln, Grimsby, Hitchin, Cambridge and Sleaford.
Great Eastern . . .	1,258	London (Liverpool St. Station), Cambridge, Lincoln, Ely, March, King's Lynn, Sleaford, Spalding, Ipswich, Yarmouth, Lowestoft, Norwich, Gainsboro, Colchester.
Great Central . . .	628	London (Marylebone), Leicester, Nottingham, Chesterfield, Sheffield, Manchester, Liverpool, Grimsby, Immingham, Lincoln, Frodingham, Rotherham, Barnsley, Gainsboro, Wrexham.
North Eastern . .	1,754	Hull, York, Darlington, Stockton, Newcastle, Sunderland, Middlesboro, Selby, Northallerton, Durham, Malton, Alnwick, Morpeth and Berwick.

Railway.	Mileage.	Principal Towns Served.
Lancashire and Yorkshire .	601	Manchester, Blackburn, Bolton, Bury, Burnley and Rochdale, Wakefield, Halifax, Huddersfield, Leeds, Bradford, Goole, Hull.
London and South Western	1,037	London (Waterloo Station), Southampton, Portsmouth, Plymouth, Windsor, Salisbury, Eastleigh, Guildford, Tavistock, Winchester, Basingstoke, Exeter.
London, Brighton and South Coast	487	London (London Bridge), Bexhill, Eastbourne, Lewes, Newhaven, Littlehampton, Brighton, Shoreham, Worthing, Horsham, Bognor, and Chichester.
South Eastern and Chatham	654	London (London Bridge), Maidstone, Tonbridge, Sheerness, Ashford, Deal, Dover, Folkestone, Canterbury, Sevenoaks, Chatham, Faversham.
SCOTCH RAILWAYS		
Caledonian . . .	1,117¾	Carlisle, Edinburgh, Glasgow, Stirling, Oban, Perth, Inverness, Montrose, Aberdeen, Dundee, Paisley, Gourock, Motherwell.
Glasgow and South Western	491½	Glasgow, Ayr, Paisley, Kilmarnock, Largs, Failie, Ardrossan, Govan, Renfrew, Stranraer, Greenock and Dumfries.
North British . . .	1,399	Edinburgh, Dunfermline, Perth, Stirling, Glasgow, Aberdeen, Montrose, Dundee, Arbroath, Carlisle, Thornton, Dumbarton, Helensburgh, Fort William.
Highland . . .	492¼	Perth, Inverness, Nairn, Keith, Wick, Strathpeffer, Bonar Bridge, Aviemore, Forres, Dingwall, Invergordon.
Great Northern (of Scotland)	334½	Aberdeen, Fraserburgh, Peterhead, Elgin, Ballater and Braemar, Banff, Keith Grange Cults, Culter.

IRISH RAILWAYS.

Railway.	Mileage.	Principal Towns Served.
Great Southern and Western	1,121¾	Dublin, Kildare, Limerick, Cork, Clonmel, Waterford, Sligo, Tralee, Rosslare Harbour, Queenstown, Monkstown, Killarney.
Great Northern (of Ireland)	561	Dublin, Drogheda, Dundalk, Portadown, Belfast, Enniskillen, Omagh, Strabane, Londonderry, Armagh, Cavan, Clones, Cookstown.
Midland and Great Western	538	Dublin, Kingscourt, Mullingar, Galway, Sligo, Athlone, Westport, Navan, Killala, Castlerea, Athenry.

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Canals & Traders (The Argument Pictorial) . . .	A. E. Pratt	Murray	—
A History of Inland Transport and Communication in England	A. E. Pratt.	Kegan Paul	6*s.*
Elements of Transportation .	E. R. Johnson	Appleton	8*s.* 6*d.*
Elements of Railway Economics	W. M. Ackworth	Clarendon Press	2*s.*
Economics of Railway Transport	S. C. Williams	Macmillan	4*s.* 6*d.*
Railways	E. R. McDermott	Methuen	5*s.* net.
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The Life of George Stephenson	S. Smiles	Murray	2*s.* 6*d.*
The Modern Locomotive .	C. E. Allen	Clay	2*s.*
American Railway Transportation	E. R. Johnson	Appleton	7*s.* 6*d.*
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Principles of Ocean Transportation	E. R. Johnson G. G. Huebner	Appleton	10*s.* 6*d.*
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Railway Map of the British Isles	. . . . .	Philip	2*s.* 6*d.* net.
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